DEC 5 1921
Engineering Library

Volume 28 DECEMBER, 1921 Number 4

MACHINERY

THE INDUSTRIAL PRESS Publishers, 140-148 LAFAYETTE ST., NEW YORK

17,000 Satisfied Users

Has Been Grinding Drills Right for 21 Years

Improved New Yankee Drill Grinder

The number of these machines in use tells the story. The New Yankee grinds drills correctly—economically—which accounts for their popularity. You'll find them everywhere—in shops all over the world—giving utmost satisfaction.

Made in 9 Belt and 8 Motor Driven Models.

WILMARTH AND MORMAN CO.

MASTER GRINDER MAKERS

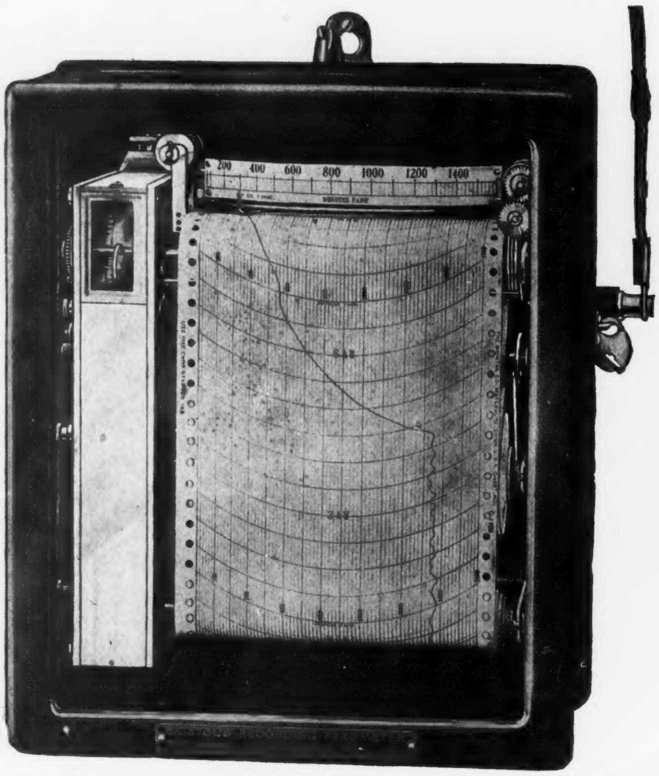
1180 MONROE AVE. GRAND RAPIDS, MICH.

TRADE MARK
BRISTOL'S
REG. U.S. PAT. OFFICE.

The Importance of Accurate Temperature Control

Take, for instance, the heat-treating process—the old way was to guess at the correct temperature; now, with Bristol's Temperature Recording Instruments, the degrees of heat are automatically recorded. The instrument is placed where the workman can observe it and thus know the exact temperature within the furnace oven, etc.

The same chart record is available for the management. It so completely maps out the conditions as they existed that it is possible to study the record with the idea of maintaining the greatest degree of efficiency—for workman—method—and equipment.



Bristol's help to bring into proper relationship the work in hand, the operator and the management. Bulletin 303-E sent on request.

THE BRISTOL COMPANY

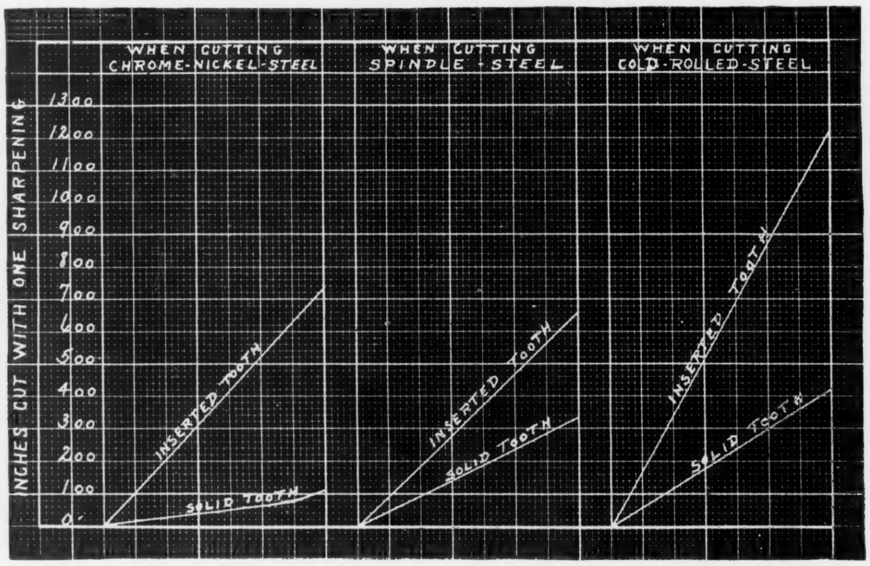
WATERBURY CONNECTICUT

THE RELATIVE EFFICIENCY OF

Solid Circular Saws and

Simonds

Inserted Tooth Saws

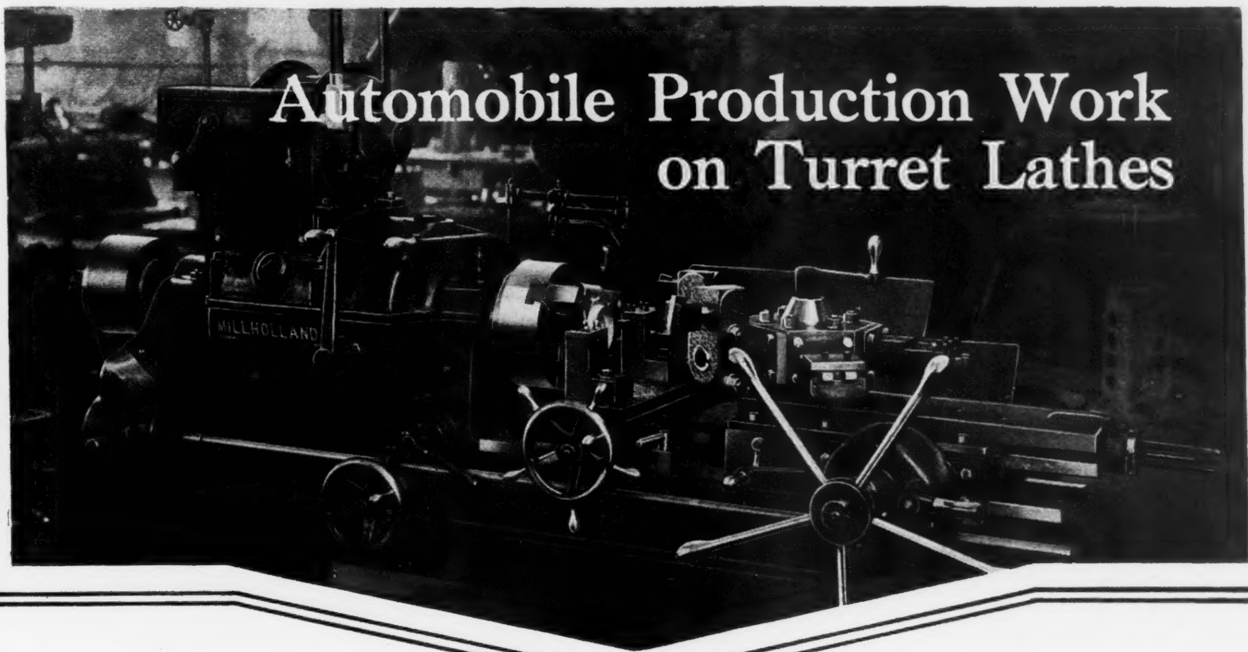


Comparative tests recently made by a large Milling Machine Company prove that Simonds Inserted Tooth Metal Saws will, on nearly every kind of steel, cut from twice to seven times as much as the solid saws.

Simonds Inserted Tooth Saw plates are made from high grade Carbon Steel and the teeth from High Speed Steel which gives them unequalled cutting and wearing qualities.

Simonds Manufacturing Company

FITCHBURG, MASS. *"The Saw Makers"* CHICAGO, ILL.



Automobile Production Work on Turret Lathes

Time-saving and Cost-reducing Methods Developed for Use in the Engine Department of a Motor Car Plant

By EDWARD K. HAMMOND

IN the engine plant of the Olds Motor Works in Lansing, Mich., a number of turret lathes built by the W. K. Millholland Machine Co., of Indianapolis, Ind., are used for machining operations on parts produced in large lots. When these machines were ordered, the turret lathe builder was also required to design and supply the work-holding fixtures and all the tools used for taking successive cuts. As all these turret lathes were to be used on repetition manufacturing work, care was taken to develop the designs in such a way that a minimum of time would be required for loading and unloading the fixtures. Wherever possible, the order of successive cuts was worked out in such a way that two or more tools could operate simultaneously. It is only through the application of such methods that repetition turret lathe work can be handled with maximum efficiency.

How To Reduce Production Costs?

This article describes a number of tools and methods that could be used to advantage in the turret lathe department of manufacturing plants handling widely diversified lines of work. Particular attention is called to the design of work-holding fixtures for locating a piece for boring eccentric holes or for turning eccentric bosses. Other valuable features of the tool equipments shown are the provision made for operating two or more cutting tools simultaneously, and the use of air chucks for increasing the speed with which castings can be set up and removed.

Machining Operations on Water Pump Bodies

Fig. 1 shows a No. 4 Millholland turret lathe equipped for the machining of Olds water pump bodies, which are made of aluminum. On this job there is a small hole (not shown) which is concentric with hole *A*. The first turret face carries a combination tool *B* for rough-boring the large hole *A* and the small hole. On the second face there is a boring-bar *C* for taking an intermediate cut in the small hole; and a reamer *D* on the third face finishes this diameter to the required degree of accuracy. The fourth turret face carries a combination tool *E* for facing three surfaces at the top and bottom of hole *A*, and at the top of a boss surrounding the small hole in the work.

A combination tool *F*, on the fifth face of the turret, breaks the corners of the work at the tops of the large and small holes; and on the sixth turret face, there is a Murchey collapsible tap *G*, which is employed for threading the small hole. The machine is equipped with a Hannifin air chuck, which greatly facilitates the rapidity with which the castings can be set up in and removed from the lathe. The rate of production attained in handling this job is twelve finished pump bodies per hour.

Machining Rear Crankcase Covers

Fig. 2 shows another No. 4 Millholland turret lathe equipped for the rapid machining of duplicate aluminum castings. The piece shown in this illustration is a rear crankcase cover and, being made of aluminum, it is of light weight and can be handled rapidly; this material can also be worked at an unusually high cutting speed, which is an important factor in expediting production. On the first face of the turret there is a plug *A* which is moved forward into contact with the work to force it firmly back against the chuck jaws prior to tightening them. In this way, a uniform location of the successive pieces of work is assured.

After the casting has been set up in the manner described,

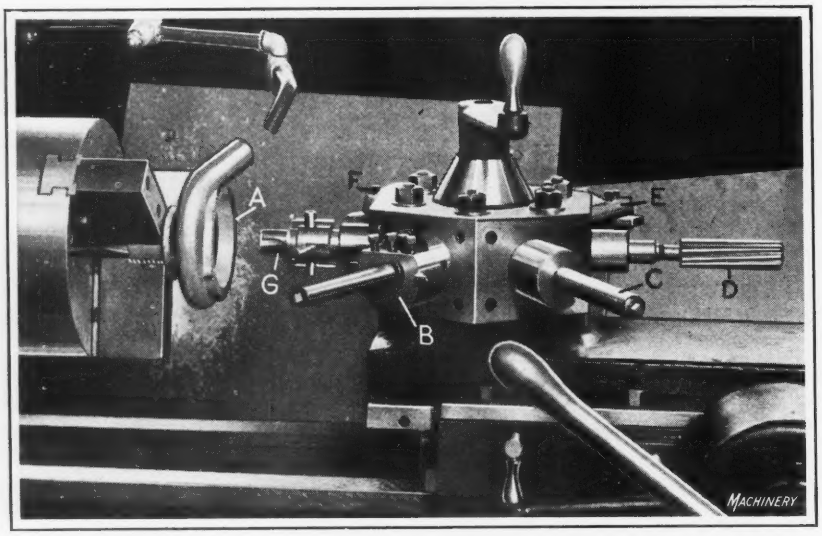


Fig. 1. Tool Equipment of a Turret Lathe used for facing, boring, reaming, and tapping Water Pump Bodies

the following sequence of operations is performed: On the second turret face, there is a tool *B* that is used for rough-boring; and the third turret face is equipped with a tool *C* for finishing the rough-bored hole. The final cut in this hole is then taken by a reamer *D* carried on the fourth turret face. The surface of a boss at the opposite side of the work from that on which the tools have been operating must now be back-faced.

For back-facing this surface, use is made of a tool-slide *E* carried by the fifth turret face, which is furnished with stops to locate the cutting tool in the proper positions for starting and concluding its cut. The tool is inserted through the opening in the work, after which the starting stop is brought into contact with it, and the point of the tool is then brought up against the work. The cross-slide on the tool-holder *E* is then brought into operation, so that the point of the tool is fed across the surface of the boss at the back of the work, thus facing it down to a uniform surface. The depth of cut is determined by means of a stop on the carriage slide. Finally, a surface *F*, adjacent to the periphery at the front of the work, is faced off with a cross-slide tool *G*.

These rear crankcase covers are cast in two pieces. As they come to the machine shown in Fig. 2, the flanges between the two halves of the casting have been milled, so that the two members may be bolted together. On this job the production is twelve rear crankcase covers per hour.

Indexing Fixture for Machining Distributor Brackets

In Fig. 3 is shown an aluminum part of the Olds engine known as a "distributor bracket," in which it is required to finish two eccentric holes and to turn and face the body. In handling this job on a lathe, it can be done only by successively locating the work in line with the center of rotation of the spindle for performing operations at different points on the casting. To obtain the three centers of rotation necessary, an indexing type of work-holding fixture is used. This fixture allows the casting to be centered in such a way that the body can be turned and faced; then it is indexed to locate the casting in position for machining one hole; and after that has been done, the fixture must be indexed a third time to locate the work for finishing the other hole.

On the first turret face, there is a tool *A* that rough-turns the outside diameter *B*, and faces the flange and lugs *C* at each side of the work. The second turret face carries a tool *D* for finishing the same surfaces. The cutter bit in each of these tools is formed in such a way that it turns the outside diameter *B* and faces the flange and lugs *C*. Feeding of the tool to the work is checked by a carriage stop. Next in the order of operations comes the facing of the area surrounding the two holes at the front *E* of the work, by a tool *F* mounted at the rear of the cross-slide. After the work has progressed to this point, it is necessary to index the fixture in order to center the work on the axis of the large hole *G;* and with the piece located in this way, a boring cut is taken with a tool *H* on the third turret face. After the boring operation, this hole is reamed with a chucking reamer *I* on the fourth face of the turret.

After the reaming operation, the fixture is once more indexed to center the casting in a position corresponding to the axis of the small hole *J;* a boring tool *K* on the fifth turret face then takes a roughing cut. Next the turret is indexed to bring a reamer on the sixth face into the operating position, for taking the finishing cut in the small hole. The work-holding fixture is mounted on a cross-slide *L*, and has an index-pin *M* which enters one of three holes to give the different work settings necessary to complete the job. It is required to hold all dimensions on this piece within limits of 0.0005 inch. Handling this job on a No. 4 Millholland turret lathe, the rate of production is eleven pieces per hour.

Machining Operations on Water Pump Impellers

In machining aluminum impellers for pumps used on Olds automobile engines, the sequence of turret lathe operations is different from that employed in the cases previously described. For the manufacture of these parts, it is necessary to remove the work from the chuck and turn it over during the process of machining, as operations are required on both sides. The method of procedure is first to face a hub at the center of the impeller with a tool *A*, Fig. 4, carried at the rear of the cross-slide. After this has been done, the work is removed from the chuck and turned over, and a small flange at the outside diameter is faced with a tool *B* mounted at the front of the cross-slide. The casting is held by means of a Hannifin air chuck, so that little time is required to set up and remove the work; hence, the necessity of resetting is not a serious hindrance.

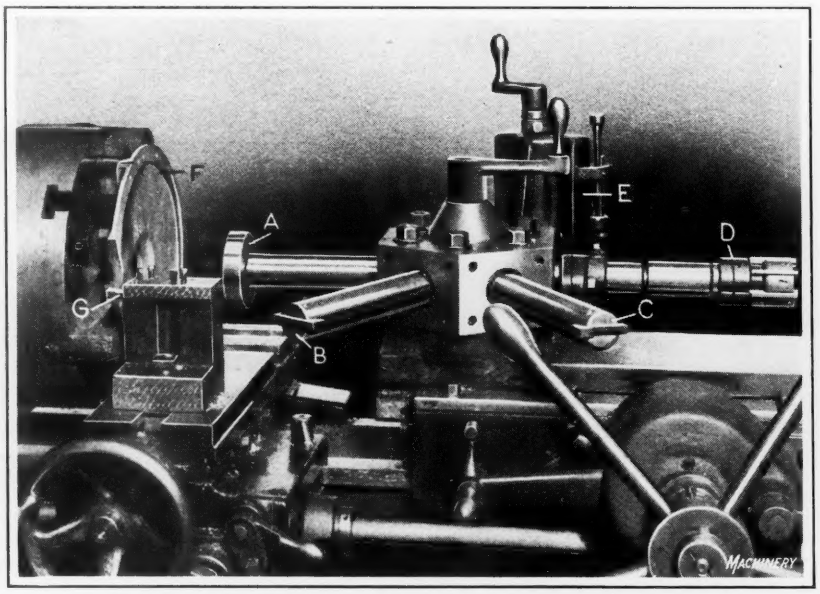


Fig. 2. Tool Equipment of a Turret Lathe used for boring, reaming, and facing Rear Crankcase Covers

After the work has been reset in the chuck, the next step is to drill the center hole and rough-turn the outside diameter of the casting. This work is done by a combination tool-holder on the first turret face, which carries a twist drill *C* and a turning tool *D*. Next the drilled hole is bored and the outside diameter finish-turned. This is done by a similar tool-holder on the second turret face, which carries a boring tool *E* and a turning tool *F*. Then a tool *G* carried on the fourth face of the turret is indexed into the operating position, for counterboring the rim and facing the area immediately surrounding the center hole in the work. When this step has been taken, the hole is reamed by a tool *H* on the fifth face of the turret. Finally, the corners at the top of the hole and at the periphery of the work are broken by a tool on the sixth turret face, thus completing the required sequence of operations. This job is handled on a No. 3 Millholland turret lathe, and the production is twenty-four pump impellers per hour.

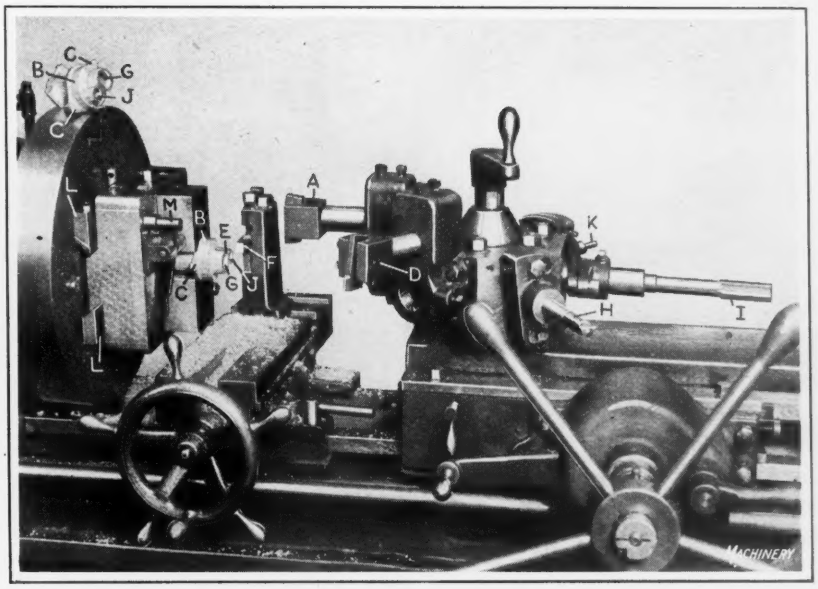


Fig. 3. Three-station Indexing Fixture for locating Distributor Brackets for turning the Body and boring Two Eccentric Holes

Machining Bronze Camshaft Bearing Bushings

When a plant is engaged in the quantity production of duplicate parts, but when the number of a given part to be machined is not great enough to occupy all the time of a machine tool, it may be possible to equip a machine in such a way that two or more production jobs can be handled, without a serious loss of time in changing tools, thus substantially reducing the amount of overhead to be charged against each of the jobs.

An example of this kind is illustrated in Fig. 5, which shows a close-up view of the tools and Hannifin air chuck used on a No. 4 Millholland turret lathe for machining bronze bushings for the front and rear camshaft bearings of the Olds engine. The rear bearing *A* is shown in position in the chuck, while one of the front bearings will be seen lying on the bed of the lathe at *B*. The procedure in machining the rear bearings is as follows: On the first turret face there is a combination tool *C* that faces the end and takes a preliminary cut on the inside of the bushing. The combination tool *D* carried on the second turret face takes an intermediate boring cut, and also breaks the corner of the hole. Reamer *E* on the third face of the turret finishes the inside diameter of the bushing.

When the machine is working on the front bearing bushings *B*, the order of operations is as follows: Rough-bore, finish-bore, face, and ream. From the description of the machining of the rear bushings, it will be apparent that there are three turret faces available for carrying tools for machining the front bearing brasses. The rough-boring tool *F*, the finish-boring tool *G* and the facing tool *H* are permanently carried on these three turret faces, so that in order to switch over from one job to the other, it is merely a case of removing the rough-boring and facing tool *C* used on the rear bearing brass *A* and substituting the holder which carries a reamer *I* for finishing the inside of the front bearing brass. The same Hannifin air chuck can be used for holding both the front and rear brasses. On each of these jobs the rate of production is twenty brasses per hour.

Machining Oil-pump Covers

In machining cast-iron covers for oil-pumps used on Olds engines, there are two holes to be finished. This is another case where an indexing type of turret lathe fixture is used for centering the work in two positions. From Fig. 6 it will be seen that the method of setting up this job is quite different from those previously described. As the castings come to the machine they have been turned and faced, and these finished surfaces are utilized as locating points. There is a space behind the top plate *A* of the work-holding fixture, and the turned diameter of the oil-pump cover enters a counterbored pocket in the back of this plate. Two hooked bolts *B* are then tightened to pull the work firmly up against the back of the fixture.

In finishing these parts, the actual machining operations are quite simple, consisting of drilling, rough-reaming, and finish-reaming one hole, after which the fixture is indexed to center the work for the same sequence of operations in the other hole. The twist drill *C* and the roughing reamer *D* are carried on the first and second turret faces; and the finishing reamer is carried by a floating holder *E* which is shown on the third turret face. It will be seen that a slip bushing *F* is provided, which enters either of two openings in the work-holding fixture to bring it into line with the positions where the holes are to be drilled in the work. The drill is guided by the bushing, while the reamer is guided by the

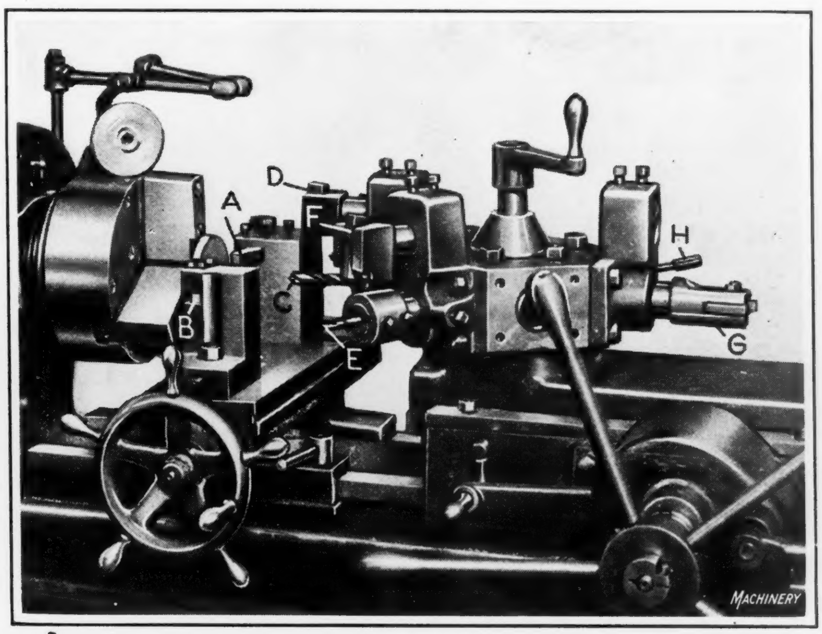


Fig. 4. Turret Lathe Equipment used for boring, counterboring, and facing Water Pump Impellers

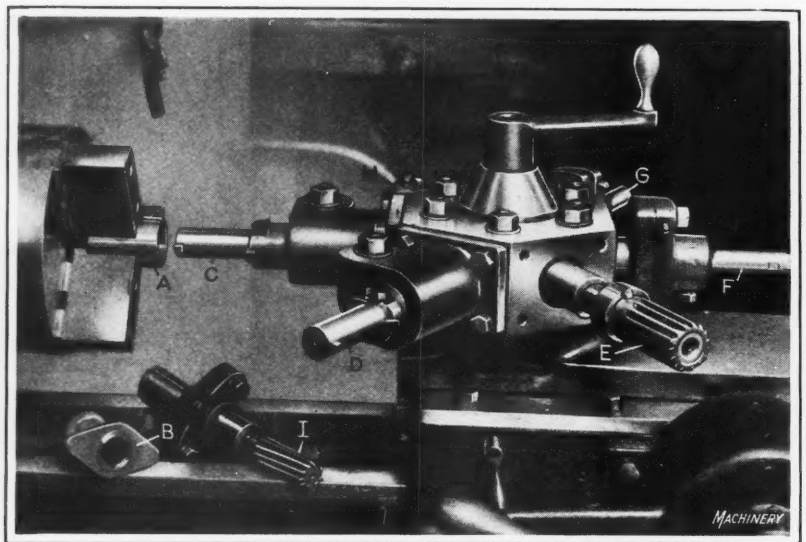


Fig. 5. Equipment for machining Bronze Bushings for Front and Rear Camshaft Bearings

finished cylindrical part of the shank directly behind the reamer blades. There is a cross-slide *G* and an index-pin *H* for locating the fixture properly for machining the two holes. In this way a good accurate job is secured. This job is done on a No. 4 Millholland turret lathe. The rate of production is twelve castings per hour.

Machining Operations on Fan Driving Pulley Hub

Fan driving pulley hubs for Olds engines are made of cast iron, and in Fig. 7 is shown a close-up view of a No. 4 Millholland turret lathe tooled up for the required machining operations on these pieces. One of the castings *A* is shown lying on the cross-slide. On the first turret face there is a twist drill *B* which takes a preliminary cut through the hub, and carried by the same tool-holder, there is a tool *C* for rough-turning the hub. Tools *D* and *E*, arranged similarly on the second turret face, bore and finish-turn the hub.

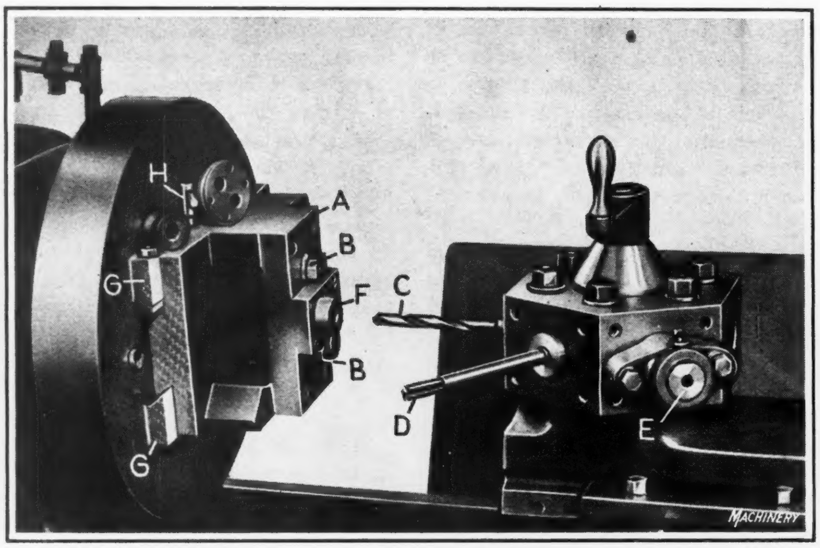


Fig. 6. Indexing Turret Lathe Fixture used for drilling and reaming Two Eccentric Holes in Oil-pump Covers

Next, it is required to break the corners of the hub and of the hole, and for this purpose a combination tool *F* is provided on the third turret face. This tool has a cutter bit slotted in such a way that the notched portion straddles the face of the hub and simultaneously breaks the corners of the hole and of the outside diameter. A reamer *G* on the fourth turret face then finishes the hole.

The next operation in the series is the facing of the front of the hub, and for this purpose there is a tool *H* mounted at the front of the cross-slide. The final operation consists of facing the back of the hub with a tool *I* carried on a rod extending through the lathe spindle and connected to the bar feed in such a way that it may be moved up into contact with the rear side of the work as it rotates. The rate of production attained in performing this series of operations is twelve castings per hour.

Turret Lathe Operations on Water Pump Covers

In the heading illustration is shown one of the No. 4 Millholland turret lathes equipped with a Hannifin air chuck and tooled up for machining covers for water pumps used on Olds engines. These pieces are made of aluminum, and it is required to perform roughing and finishing operations on the front faces of the flange and hub. Two tools are provided at the rear of the cross-slide, which simultaneously rough these two faces of the work, and after the preliminary cut has been taken, two similar tools mounted at the front of the cross-slide, perform the finishing operations on the same surfaces of the work.

On the first face of the turret, there is a drill for taking a preliminary cut through the center hole, and another tool with which a rough-turning operation is performed on the outside of the hub. On the second turret face, a similar tool provides for finish-turning the hub. Carried on the third face of the turret, there is a tool for facing the area adjacent to the center hole in the work. Finally, on the fourth face of the turret, there is a combination tool that breaks the corners of the inside of the hole and the outside of the hub. It consists of a holder with two bits, one of which extends farther than the other, so that it is able to reach the hole which is some distance inside the level of the front face of the hub. The rate of production in performing the machining operations on these water pump covers is eighteen pieces per hour.

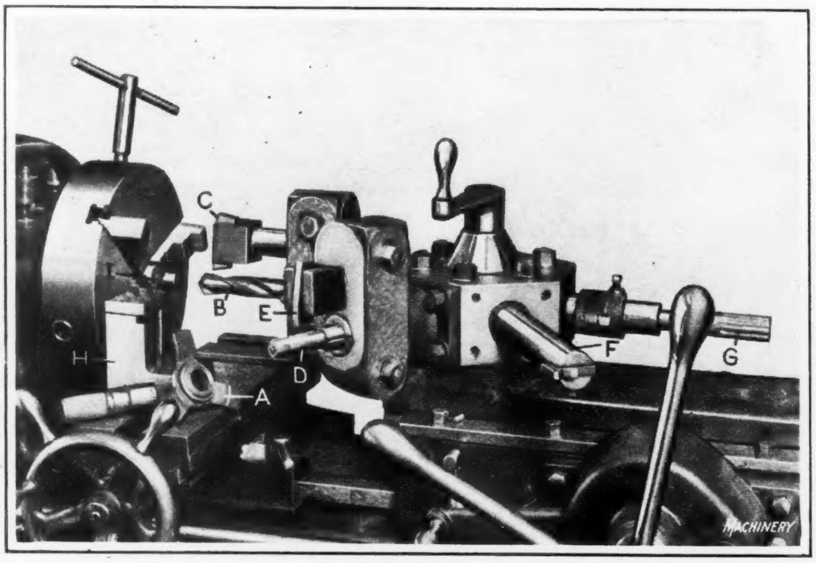


Fig. 7. Equipment for machining Hubs of Fan Driving Pulleys

Some Aspects of the Present Situation

By A. W. HENN, President, National Acme Co., Cleveland, Ohio

THE question that doubtless causes the greatest amount of anxiety in the machine tool field today is prompted by the great expansion in the industry during the last five years. Many believe that it will be several years before there will be sufficient demand for machine tools to absorb the entire machine-building capacity of the country as we know it today. This belief seems reasonable, and in view of all conditions to which we can point today, it would seem entirely too optimistic to hold a contrary view. The foreign trade, which in past depressions has been an important source of business, is at the present time reduced to very small proportions; and in the domestic field there is no great and important outlet for machine tools in view. Hence, it would seem that a much smaller machine tool building capacity than that at present available would be sufficient to meet the needs of both the domestic and the foreign trade for several years to come.

What has been our Past Experience?

As I look back upon my experience in the machine tool field for the last thirty years, however, I find that we have passed through several periods that in many respects were similar to the present one, although the details differ, and in view of those experiences it is difficult to look toward the future without considerable faith in the prospects of the machine tool industry. In the early nineties, previous to the depression which then held the country in its grip for several years, there was a great expansion in the machine tool industry. Many new concerns were started, and as compared with the ten years previous, the expansion in the machine tool building capacity of the country assumed great proportions; so much so that when the depression struck us, many of the older machine tool builders pointed to what they called an over-expansion, and predicted that it would be a great many years before the demands for machine tools would be equal to the capacity then existing. Yet a few years later—owing in a large measure to the activity in the bicycle industry—not only did the domestic and foreign trade absorb the entire capacity at that time, but the demand was so great that in the late nineties a number of new concerns started which have since grown into important factors in our machine tool industry, and which have found ever since sufficient employment for their activities to warrant their existence.

In the fall of 1903 we had another depression, and there did not seem to be a reasonable prospect for an early revival. Yet a couple of years later the machine tool builders found themselves engaged to capacity in building machine tools for many industries, but largely for the automobile industry which then entered upon its first stage of real development. A few years later we entered upon another depression, again followed by a boom and an expansion in the machine tool industry due to the second expansion in the automobile industry. In 1914 business was again almost at a standstill, and many manufacturers were working almost exclusively for stock. Then came the war with the effect on the industry well known to everybody; and finally, after the armistice, when everyone in the machine tool business predicted several years of stagnation because the world had all the machine tools that it could absorb for five years to come, at least, we found ourselves after a few months again fully occupied in building machine tools for various industrial purposes, but mainly for what might be called the third stage of development in the automobile industry.

Now we have again reached the bottom of a depression, and we can see nothing definitely ahead for years to come. Yet, in the light of past experiences, it is almost certain that the new developments that are constantly taking place in the entire industrial field will make demands on the machine tool builders, so that the industry that now appears to be over-expanded will again find itself occupied to such an extent that it will regain a healthy condition. It seems quite certain that we have already passed the lowest point in the depression. In many cases in the machine tool industry this occurred in July and August, with a slow but steady improvement since that time.

Possible Outlets for Machine Tools

As soon as business conditions in the general industrial field become normal, or nearly so, the machine tool builder will find an outlet for his products in two directions: He will enter new fields where machine tools will be required for the manufacture of new articles constantly being invented for the comfort and convenience of modern life, and he will be busy replacing machines that have become obsolete, with new and improved types. In the foreign trade the greatest opportunities now seem to offer themselves in the Far East, there being little hope for any great demand from Europe for some time to come. We all know that the railroad field would offer a great opportunity for machine tool equipment, if the railways were financially in a position to buy. This problem is a difficult one, and at present it is the most pressing of any now confronting us as an industrial nation. Freight rates must be reduced, but in order to reduce freight rates there must also come reductions in wages and an increase in the working efficiency of railroad employes.

The most important thing in regard to wages at the present time is not so much what might be termed a *reduction* in wages, as an *equalization* in wages. There are certain classes of labor that have not received, during the last five years, any more than a fair compensation for their work. There have been other classes of labor, again, who have received a great deal more, proportionately, than their fellow workers. Compare, for example, the wages in the railroad field and in the building industries with those in the general machine building field, and it becomes evident that in justice to the highly skilled men in the field last mentioned, the wages of overpaid workers should be proportionately reduced. In that manner industry can get under way again, and the prosperity of all can be insured.

Importance of Education of Workers

The last years have been an era of extravagance—there has been waste not only of money and the things bought with money, but also of time. The young men who years ago entered the trade devoted their spare time to study in order to qualify themselves by knowledge and skill in that trade. During recent years of high wages and short hours, the spare time has not generally been thus employed. Motion pictures and other pleasures and entertainments have taken a position in our community life that has temporarily overshadowed the value of educational development along specialized lines.

The motion picture, however, lends itself exceptionally well to the furthering of an educational campaign, and it is to be expected that after the present era of abnormal conditions, we will see this effective means of transmitting information used more and more for serious purposes.

Reducing Costs by Gang Drilling

How To Reduce Production Costs ?

THE practice of grouping machines to facilitate the performance of a number of operations in rapid succession on a part, or the mounting of several machines in a gang on one base for the same purpose, makes possible high production rates at low costs. The accompanying illustrations are representative of typical jobs on which standard machines built by the Barnes Drill Co., Rockford, Ill., have been successfully applied to effect reductions in manufacturing costs. The photograph reproduced in Fig. 1 was taken in the shops of the Benjamin Electric Mfg. Co., Chicago, Ill., and shows three drilling machines and one tapping machine placed in a line for the manufacture of small flanged parts.

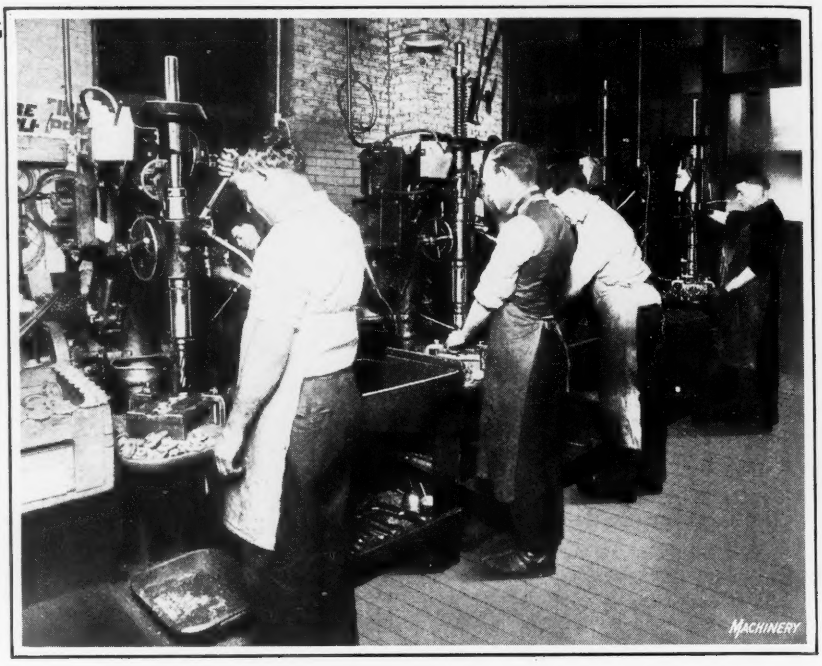


Fig. 1. Three Drilling Machines and a Tapping Machine grouped to obtain High Production Rates on a Small Flanged Part

Each machine is supplied with an individual motor drive and a controller. The machine at the left is used for drilling a hole through the center of the part, and the next machine is employed for tapping this hole. The third machine turns and faces the hub, while the tapping machine at the extreme right threads the hub, a Wells self-opening die-head being utilized for this operation. The outside diameter of the hub is 1 inch, and the length of the threaded portion $3/8$ inch. The production obtained with these machines averages 334 completed parts per hour.

Drilling Automobile Axles

An all-geared gang drilling machine equipped with four 24-inch adjustable spindle heads is used in the plant of the Adams Axle Co., Findlay, Ohio, for drilling the king-pin hole at each end of an automobile axle and the spring-pad holes. This operation is illustrated in Fig. 2. The center distance between the spindles at each end is about 12 inches. The outside spindles and their guide bushings have a quick adjustment to compensate for small variations in the lengths of axles. This adjustment is obtained by revolving the handwheel at the right to rotate a shaft having threads engaging with nuts, which shift the spindle heads and jig members to the desired locations. Special equipment is supplied for supporting and locating the axle forgings, which are made from S. A. E. specification No. 1035 steel. The inner spindles used for drilling the spring-pad holes are each provided with a five-spindle auxiliary head.

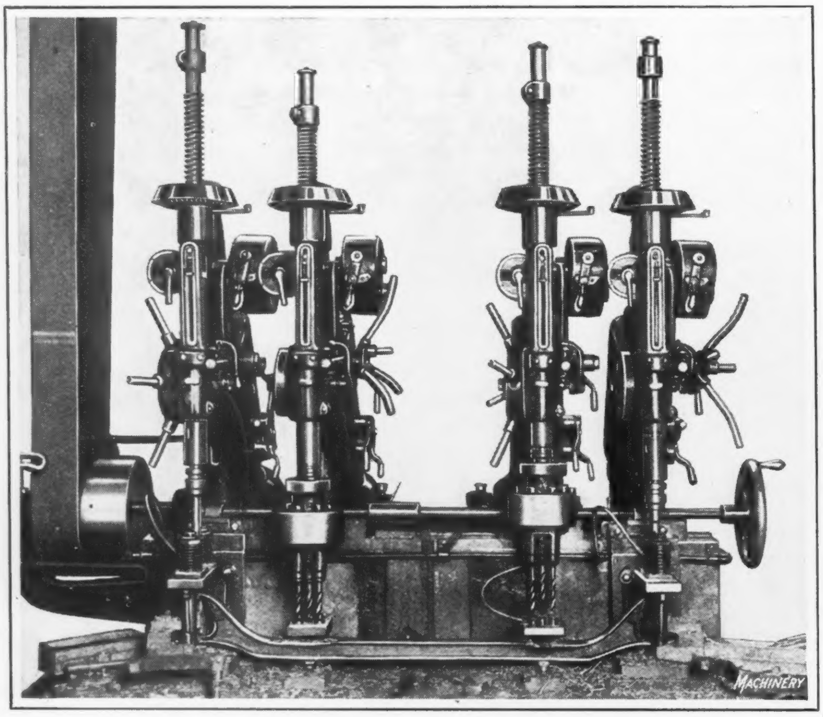


Fig. 2. Four-spindle Gang Drilling Machine used in the Manufacture of an Automobile Axle

At the top of each main spindle there is a coil spring and adjustable return stops. When an operation is completed the automatic feed is tripped, and the spindle and tool are lifted, through the action of the coil spring, sufficiently to clear the work. The raised position is governed by a shock absorber, located in a sliding member at the front of each head, with which the upper end of the spindle sleeve comes in contact. The king-pin holes are drilled 31/32 inch in diameter and reamed to 1 inch in diameter, while the spring-pad holes are drilled 17/32 and $\frac{1}{2}$ inch in diameter. The production obtained with this machine is from ten to twelve axles per hour, with the drills driven and fed at their maximum speeds and feeds, respectively.

Machining Forged Clutch Levers on Gang Drilling Machine

Another four-spindle gang drilling machine having independent columns and tables is employed by the Hart-Parr Co., Charles City, Iowa, for drilling, reaming, and hollow-milling operations on forged clutch levers. This machine is illustrated in Fig. 3. The spindles are equipped with an automatic raising mechanism similar to that described

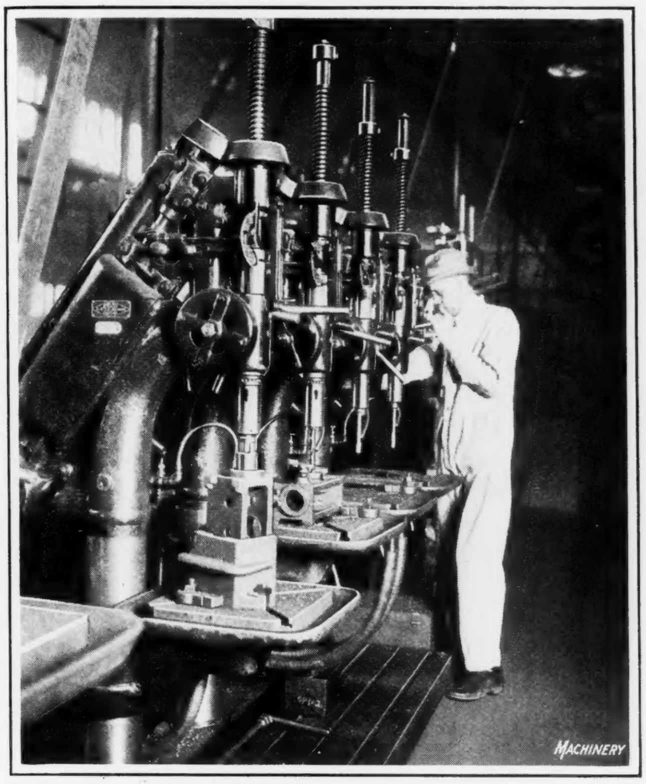


Fig. 3. Four-spindle Gang Drilling Machine used for machining Forged Clutch Levers

in connection with the machine shown in Fig. 2. In feeding a spindle, the operator simply lifts a throw-in lever and begins to feed. One operator attends to the four spindles, dividing his time about evenly between them. The production rate attained with this machine is one lever per minute or sixty per hour.

* * *

NATIONAL INDUSTRIAL COST CONFERENCE

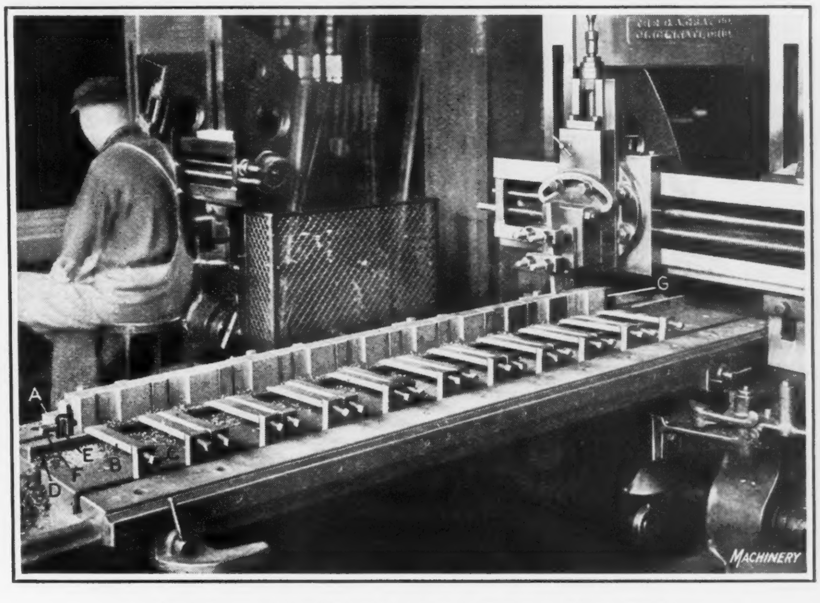
The Industrial Cost Association held its second national conference in Pittsburg, Pa., November 2 to 4. The objects of the association are to stimulate the interest of all manufacturers in correctly determined costs; to standardize cost and accounting terminology and establish governing principles in order to simplify cost accounting; to educate the members in the use and advantages of graphic charts and other methods of cost analysis and control; to assist members who are identified with cost committees of trade organizations in formulating uniform cost methods and to recommend the adoption of such methods; to provide a forum for the discussion of cost problems and practices through general and local meetings, and to gather and disseminate such information; to establish a cost library and maintain a bureau of information through which members may be assisted in solving their individual cost problems; and to coordinate the efforts of members so that cost of production may be considered in its proper relation to the problems of industrial management. Among the papers presented were: "What the Sales Manager Should Have from the Accounting Department"; "Inventories—Methods of Taking"; "Responsibility of the Comptroller or Accountant in Times of Business Depression"; "Terminology"; "Budgeting the Plant and Office"; "Sanitation and Safety"; "Cost and Profits of Welfare, Sanitation, and Safety"; "Looking into the Future"; and "How Can a Cost System, Although Efficient, Demoralize an Organization?".

MULTIPLE SET-UPS FOR PLANING

Attention has previously been called in these columns to the advantages of setting up a number of pieces of work at one time for planing. In this way the non-productive time of the machine is decreased, and the setting-up time per piece is usually less.

The economies resulting from this method of setting up work for planing are not always in direct proportion to the number of pieces that are set up at one time. For example, in one case where milling machine table castings were to be planed, two set-ups were tried, and it was found more economical to do the work with four castings set up at a time, rather than with eight, although ample power was provided to pull the work under the planer tools in each case. This is probably due to the fact that when too many pieces are set up at one time the non-productive time of the machine while the operator is engaged in setting up the work, and the idle time of the operator while the machine is at work, more than counterbalance the savings effected by the multiple set-up. The number of pieces that can best be planed at a time can only be determined by experience in handling many different classes of work, or by experimenting for each new job.

An example of the way in which a string of castings can be advantageously set up on a planer is shown in the accompanying illustration. The method of mounting is the important point in this case, because the job itself is very simple, consisting merely of planing a flat top face on each of ten castings. The planer is a 24- by 28-inch machine built by the G. A. Gray Co., of Cincinnati, Ohio, and it is shown in use in the plant of the National Acme Co., Cleveland, Ohio. Secured to the planer table there is a finished parallel bar *A*, the sides of which are in accurate alignment with the line of travel of the planer table. This bar is used as the locating point against which the castings are clamped by fingers or so-called "butters" *B*, which are tightened against the work by bolts *C* carried by stops placed in one of the table T-slots. A bar *D* is placed on the planer table to support the forward end of the clamping fingers *B*, so that their pressure is applied at a point about midway up the side of locating bar *A*. Means for supporting the end thrust of the cutting tools are furnished by a plug *E* placed in one of the clamping bolt holes in the table; this plug carries a bolt *F* which is screwed up against the end of the first casting. As all of the pieces of work are in contact with each other, end to end, it will be evident that pressure is transmitted from one piece to another. At the opposite end of the string of castings there is a plug *G* against which the work is tightened by bolt *F*.



Application of the Multiple Set-up Principle on Planer Work

Planning in Large Contract Plants

Organization of a Department for Planning the Progress of Work through the Shop

By GEORGE H. SHEPARD, Professor of Industrial Engineering and Management, Purdue University

ADEQUATE planning in a large contract or jobbing plant requires a well-organized planning department. This department should be a part of the shop organization with each departmental chief planner directly under the authority of the general foreman of the particular department, as shown in the organization diagrams presented in connection with the article entitled "Organization of Large Contract Plants," which was published in August MACHINERY.

The accompanying diagram shows the organization of a planning department in a contract or jobbing machine shop employing about one thousand workmen. It will be noted that the departmental chief planner is again directly responsible to the general foreman, and that the technical experts who are in an advisory relation to the method man are responsible only to the chief of staff. The following detailed description of a departmental planning office is based on an actual functioning organization, plans for which were originally prepared by W. H. Smith, first assistant to the author at the time when he was engaged in this line of work.

Purpose of a Planning Department

The general foreman of a large plant requires a special organization to assist him in handling the vast amount of detail involved in properly planning and preparing the work of the various shops, and, this is the particular function of a planning department. In the organization illustrated, the planning department provides a central point to which persons outside of the machine shop send all information and instructions which pertain to the work to be done by the shop. The planning department converts such information and instructions into shape for use in the shop. In so doing, the actual functions of the planning department consist of: (1) Issuing instructions as to what, how, where, and when work will be done; (2) providing all material, special tools, etc., necessary to complete the work on a given job; (3) keeping record of the actual progress and production of work to know how the scheduled plans are being carried out.

Many a shop has a staff of executives highly experienced in machine shop work and capable in devising and introducing labor-saving methods. Such shops may be excellently equipped with modern machine tools, and have every facility for producing at low cost, and yet find it difficult to compete with other plants less ably manned and equipped. The difficulty can sometimes be traced back to the lack of proper planning of the work, which sometimes is overlooked even by the best mechanical executives. Careful planning is especially necessary in shops where a variety of work is handled; for lack of planning may, in cases of that kind, greatly increase costs. A study of the possibilities for reducing costs by adequate planning of the work in the shop is well worth the careful attention of the best executive.

Function of Each Man or Unit in the Organization

According to the organization diagram the departmental chief planner has general charge of the department. The method man is the first assistant to the chief planner, and when the latter is absent, he automatically becomes the head of the department. The progress man is directly responsible to the chief planner, but in the absence of this supervisor he reports to the method man. The material man, planners, and the blueprint man are directly responsible to the method man; men in the material section, to the material man; men in the progress section, to the progress man; and jacket file clerks and messengers, to the departmental chief planner. The duties of each man are given in the following:

Departmental Chief Planner. The departmental chief planner has general supervision of the planning department and is responsible for its efficiency and results obtained. His main duty is to see that the various sections of the office are performing their work properly. He should handle personally only the most important questions, turning over all detail work possible to his subordinates, and to that end should train them to handle whatever work he gives them.

Method Man — The method man has general supervision of the method section and should maintain the same rela-

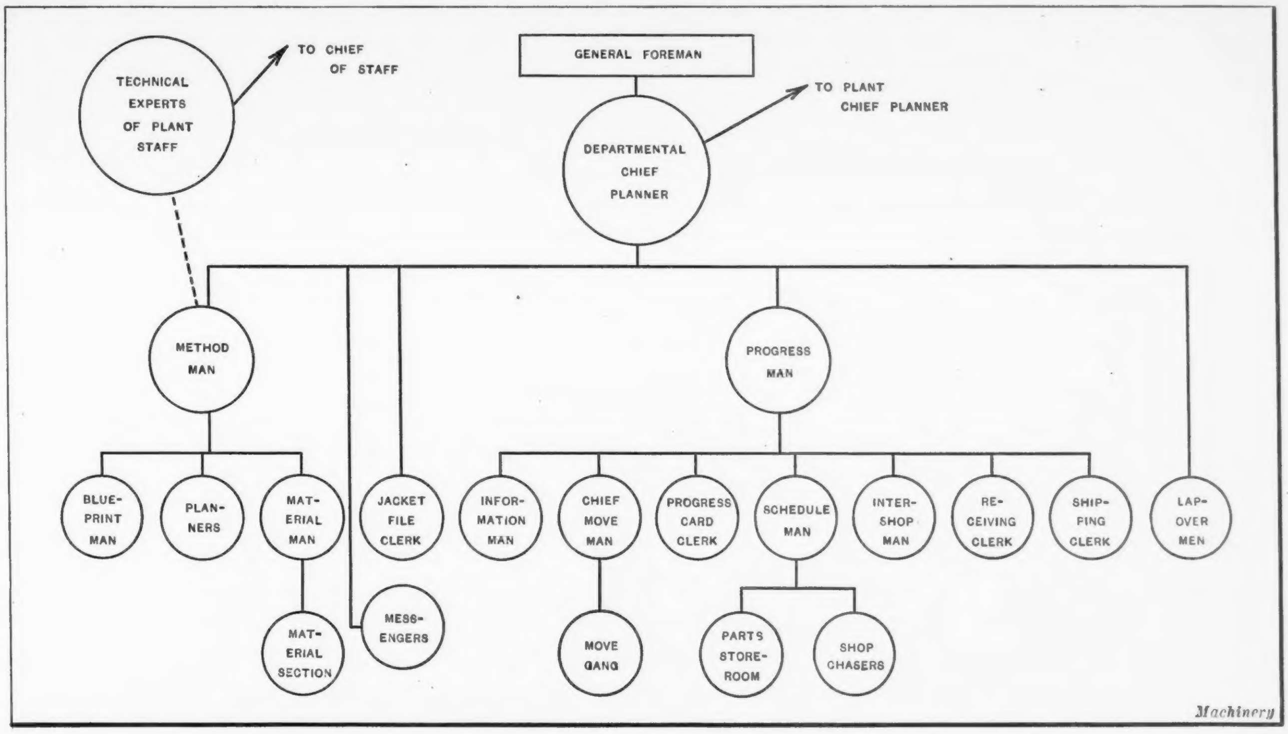
tion to that section as does the departmental chief planner to the entire department. He is responsible for the clerical work involved in writing up instruction cards, progress cards, etc., and should see that the planners analyze the jobs correctly. He should answer all questions from shop supervisors pertaining to the work of the planners and should consult fully regarding the various details with the technical experts of the plant staff.

Progress Man—The progress man has general supervision of the progress section and should maintain the same relation to that section as does the departmental chief planner to the whole department. The progress man is responsible for the accuracy of progress records, the soundness of schedule dates, and the constant surveillance of work in the shop to see that it is not delayed. He should reply to important inquiries from outside of the shop and from supervisors relative to the work in his section.

Planners—The work of the planners is to decide what

Blueprint Man—The blueprint man obtains the necessary number of blueprints for a job from the drawing-room as directed by a planner, and files them. He issues them to the shop as directed by the planner, or when called for by the shop. He keeps an index of the blueprint file showing the supply of prints on hand, and to whom prints have been issued.

Material Man—The material man keeps a perpetual inventory of material in shop stores, and looks after the replenishment of the material; issues all necessary requisitions for material from stores, and has the material delivered to the shop. He is also assistant to the method man relative to materials, and in such matters, his decisions are accepted by the planners. In this capacity the material man must keep in close touch with the condition of materials in store, must carefully censor all lists of material for jobs made out by the planners, and take up doubtful points with them. In short, his main duty is to secure the most economical



Organization of a Planning Department for a Machine Shop employing about One Thousand Workmen

work must be done; what operations are to be performed on each job; what classes of machines are to be used and the routing of the work from section to section of the shop; what kind and size of material is to be used; and as far as possible, what special tools will be needed.

In making these decisions the planners should consult job orders, drawings, and other instructions, and inspect samples and equipment to be repaired, etc. The aim of planners should be: (1) To specify the most economical method of performing operations from the standpoint of time and equipment; (2) to assign the jobs to machines best adapted to the work; (3) to make the best possible use of material, that is, a piece of material should be no larger than necessary to do the job. If the kind of material is not specified, the least expensive material suitable for the job should be used; tobin bronze should not be used in cases where brass would do, and solid material should not be used when a casting or forging would be more economical.

Planners write the necessary instructions and route tags to cover the jobs, and advise the blueprint man as to what sections of the shop should receive prints. In handling repair work, planners are responsible for issuing sufficient instructions to do the work properly. Planners should endeavor to foresee what will be required to complete a job and should either make necessary provision for it, or else refer the case to the method man.

specifications from the planning office, so planners should consult him freely as to the availability of material.

General Function of Progress Section

Repair jobs coming to a plant, as a rule, must be completed by a certain date, and, in the same way, job orders on new work may have to be finished at stated times. It is the work of the progress section not only to determine when each job shall be done, but also to secure information, material from other shops, etc., and to guide the work through the shop so that each job order will be finished by the specified date.

Inter-shop Man—The inter-shop man deals with other shops in the plant for the planning office and determines when the machine shop should deliver work on a job order to the next shop, so the latter will be able to complete work in time; secures from other shops any information needed by the machine shop in completing its work; consults the progress man or the schedule man, and then advises shops which feed work into the machine shop when the work should be delivered to it; and follows up these other shops when they fail to deliver material on the date specified.

Schedule Man—The work of the schedule man is: (1) To make a daily schedule of important jobs, showing the required dates of completion, and to issue this list to the foremen. This schedule is the means whereby the planning

department guides work through the shops, and sets completion dates for the shops to attain and for the general foreman to hold the shops to. (2) To make a daily schedule of important jobs to be worked on at night by the night shift. (3) To watch the progress of every item on all classes of orders, particularly important work, by using the progress section records and shop chasers, to see that nothing falls behind. He should start action on delayed items through the inter-shop man where other shops are involved, and through the shop chasers or the progress man where the machine shop is at fault. (4) To notify the method man when any job orders ahead of the shop should be planned by the planners, the information being obtained by reference to the progress section records. (5) To keep in touch with the store-room man by means of shop chasers as to the condition of the assemblies in the store-room, and take action to get assemblies ready for the assembly section, reference also being made to the progress section records.

Parts Store-room—It is essential to economical production that, when a job is sent to the assembly section, all the necessary parts are together, so that the job can be worked on steadily until completed, and then shipped out of the section. In this way only live jobs will be on the assembly floor, and there will be no delay because parts are lacking. This is true for sub-assemblies as well as for final assemblies. To attain this end it is necessary to collect the parts after they have been machined until all parts for one job are ready for assembly. The store-room provides a reservoir in which these parts can be collected and turned over to the assembly section as a complete group. The planners, therefore, route all such parts to the store-room preparatory to assembly.

The superintendent or general foreman of a large contract plant requires a special organization to assist him in handling the immense amount of detail involved in properly planning and preparing the work of the various departments, and this is the particular function of a planning room. The planning department provides a central point to which is sent all the required information and instructions from the customers' plants which pertain to the work to be done by the shop. The planning department converts this information and all instructions given into proper shape for use in the shop.

In order to expedite work it is equally essential that the planning department have some means of knowing definitely at all times what parts are ready for an assembly and what parts are lacking. It is apparent that different parts take different routes through the shops and require varying amounts of machine work. The store-room provides a means whereby the planning department can know just how assemblies stand; hence, parts which are lacking can be pushed. For this purpose, a card-index inventory is kept of parts in the store-room. The store-room also serves to collect partial deliveries of castings from the foundry until all the castings for a part have been received, at which time they are sent through the shops. By this means the planning office can avoid the machining of castings in partial lots with the consequent extra expense.

Shop Chasers—The shop chasers secure any information on work in the machine shop asked for by the schedule man. Each chaser has certain jobs assigned to him to watch particularly, and any noteworthy facts observed are reported to the schedule man.

Information Man—The information man answers all questions relating to the status of work in which the machine shop is involved, and acts as a censor on the condition of the progress section records, calling any defects to the attention of the progress man.

Chief Move Man and Move Gang—The move men who are not definitely assigned to a section of the shop and work directly under its foreman for movement within the section only, are organized in a general gang under the chief move man. The duties of the latter in directing this gang are, in the main, to carry out inter-sectional movement, as directed by the route tags on work deposited at the outgoing space by the section move men. The chief move man is in all matters under the orders of the progress man, and will perform such other duties as the latter may direct.

Progress Card Clerk—The duties of the progress card clerk are to keep the records of the progress section; the various forms used will be discussed in a subsequent article.

Receiving Clerk—The duties of the receiving clerk are to check incoming material and turn in all papers, shipping tags, etc., to the progress card clerk, after ascertaining whether all essential information is on the papers and tags. He sends partial deliveries of castings to the parts store-room.

Shipping Clerk—The shipping clerk sees that every sample piece of work delivered from the shop is provided with a delivery tag. He also insures proper identification of work sent to another shop for repairs.

Jacket File Clerk—The file of jackets (large manila envelopes) provides a receptacle for each job order for copies of all written matter pertaining to an order, job order, instructions, tags, etc. This is a reference file only, and the majority of questions as to the status of work should be answered from the progress section records as previously mentioned.

Messengers—The messengers maintain a mail service within the planning department between the office and the shop, and between sections of the shop. They also perform miscellaneous messenger work.

Lap-over Men—The duties of the lap-over men are to consult day foremen and assistant foremen and arrange the work for the night force of workmen.

* * *

SIMPLIFICATION OF AUTOMOBILE DESIGN

With reduced prices for automobiles comes, by necessity, renewed efforts to reduce manufacturing costs. These reductions will come about partly through lower labor costs and improved means of production, but also through renewed activity among automobile manufacturers and their engineering staffs toward greater simplicity in automobile design. It is apparent that the fewer the parts, the less the cost, and it is also more generally recognized than ever before that the fewer the parts, the less the liability of trouble to the user. The Willys-Overland Co. is especially emphasizing this point in a recent circular, pointing to the fact that if fewer parts reduce motor troubles they will tend to increase the reputation of the car, increase the sales, make possible greater production, and, through greater production, reduce manufacturing costs. There is much food for thought in this reasoning, and there is no doubt that there is still great room for improvement in the simplification of automobile design and in so arranging the parts that may need adjustment that they are easily accessible.

* * *

DUTCH EAST INDIAN MACHINE TOOL MARKET

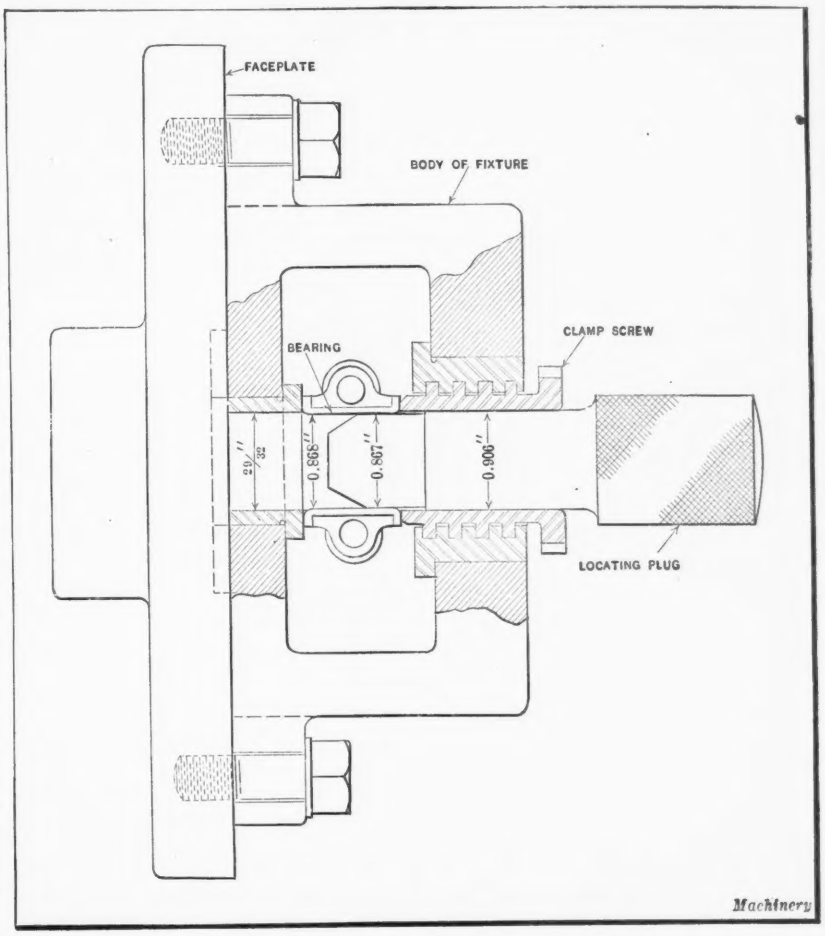
The Dutch East Indies are a colony with which Americans as a whole are not very well acquainted. The Island of Java is practically as long as the distance from Chicago to New York and has a population of 39,000,000 people. In addition to the sugar industry, there is the rubber industry, and the mining industry. The Dutch East Indies are the greatest tin producers in the world. The exports of metal-working machinery ran from $4000 in 1910 to $326,000 in 1920, while in 1919 the machine tool exports alone amounted to $614,000.

REDUCING COST OF FITTING CONNECTING-ROD BEARINGS

By A. K. SCHWARZ
Superintendent, American Motorcycle Mfg. Co., Louisville, Ky.

The writer was recently confronted with the problem of cutting down the cost of fitting and assembling the split bearings at the large ends of connecting-rods used on small motorcycle engines of the two-cylinder opposed type. Owing to the scarcity of skilled mechanics in the locality in which the plant was situated, this problem proved anything but an easy one to solve. The halves of the bearing referred to are made of the best grade of bronze obtainable, and run on carburized, hardened, and ground crankpins, 7/8 inch in diameter by 15/16 inch in length. The piston displacement of the engine is 21 cubic inches, and the maximum speed of the engine under load is 4100 revolutions per minute. These facts are mentioned to show the necessity of obtaining as nearly a perfectly fitted bearing as possible.

Broaches and several types of reamers were given a trial, but owing to the light sections of the connecting-rod, they did not produce a hole having the required roundness and straightness. As a last resort grinding was tried. This method proved a complete success, and in fact, resulted in the production of a better bearing than the writer has ever seen produced by other methods. A set of bearings finished in this manner, which were carefully examined after a run of 500 miles, were found to be in such good condition that less than 0.001 inch removed from the shims between the halves of the bearing would cause the shaft to bind or "freeze." The speed of the motorcycle during this run was thirty miles per hour. The speed ratio between the motor crankshaft and the motorcycle wheel equipped with tires 26 inches in diameter was 6½ to 1.



Fixture used in grinding Connecting-rod Bearing

The following description of the method and grinding fixture developed for grinding the connecting-rod bearing may be of interest to those having similar work to do. The connecting-rod caps with the bearing shells in place were faced off on a disk grinder to allow from 0.005 to 0.007 inch for finish-grinding the bearing to the required diameter. While the fixture illustrated was being built, a grinding wheel manufacturer was asked to recommend a grinding wheel for this job. Using the wheel recommended, the actual time required to grind the bearing was about 3½ minutes, while the time necessary for loading and unloading the fixture was about forty seconds. The limits on the 0.875 diameter were plus 0.0005 and minus 0. Before adopting the grinding method, it required two hours to produce a hand-finished bearing which would be passable, and even then it was not nearly as perfect as one finished by grinding.

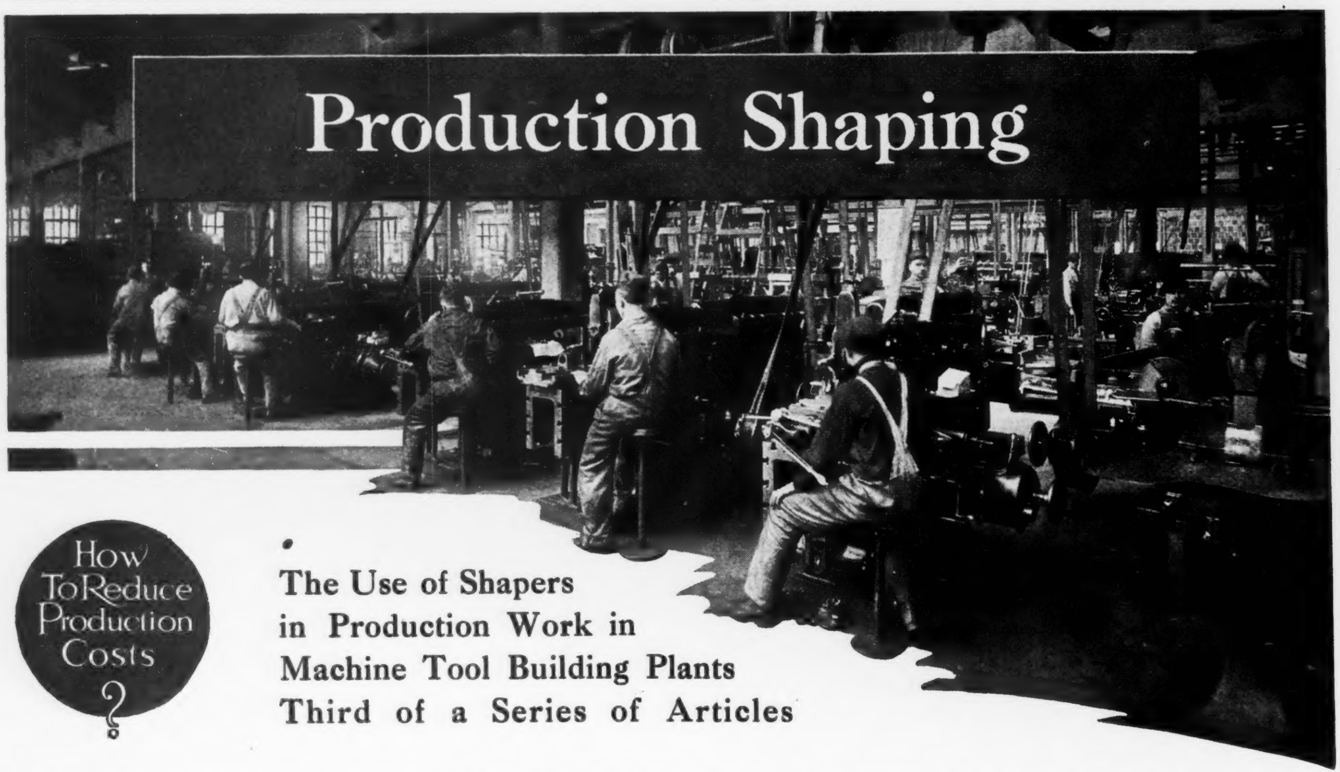
UNDERPAID POSTAGE ON FOREIGN MAILS

The American Chamber of Commerce in France calls attention to the constant lack of full foreign postage on mail received from the United States. It is pointed out that much adverse criticism results from sending letters, circulars, and advertising matter with underpaid postage to foreign countries. The penalty paid by the receiver is double the amount of postage lacking, so that on a letter that should have five cents postage, mailed with a two-cent stamp, the penalty payment would be six cents. Now six cents, it is pointed out, is not much, but if 100 letters are received with underpaid postage, the extra expense amounts to $6 or, at present exchange, nearly 100 francs.

It is also pointed out that the United States appears to be the only country in the world where business houses do not put sufficient postage on their foreign mail and that, therefore, the feeling of resentment toward this country is all the greater. Attention is called to cases where an agency abroad had gone to the trouble of writing to the firms who had sent letters with underpaid postage, and in several cases very nice letters were received in reply with two-cent stamps on them, so that it was necessary to pay the penalty again.

One correspondent refers to a case of a firm doing business with him, that always sent him letters with short-paid postage. He collected all the envelopes with the penalty stamps due, and returned them to this firm. In reply, he received a very apologetic letter, and was allowed full credit for the amount of underpaid postage, but the reply was placed in an envelope with a two-cent stamp, so that he paid extra postage to receive the apology, and to cap the climax, he received a Christmas card on which he was obliged to pay extra postage.

This neglect on the part of American business houses finally resulted in a complaint being made to the Postmaster General at Washington, about the amount of mail that is allowed to leave the United States with underpaid postage. The Department took up the question at considerable length; the correspondent who made the complaint received a copy of the departmental circular being sent out relating to the matter, together with copies of the entire correspondence. When this letter from the Post Office Department of the United States was received it had on it a postage-due stamp, so that the correspondent was obliged to pay the equivalent of twenty cents in order to find out what the Postmaster General had to say about the matter. Recently, however, a ruling has been made by the Post Office that all foreign mail on which the postage is underpaid will be returned to the sender, provided a return address is on the envelope.



Production Shaping

How To Reduce Production Costs ?

The Use of Shapers in Production Work in Machine Tool Building Plants
Third of a Series of Articles

THE shaper is a machine having sufficient flexibility to adapt it for handling a wide range of production work, provided care is taken in the planning of operations and in the designing of tools and fixtures. The following article illustrates the application of shapers for the performance of miscellaneous manufacturing operations in machine tool building plants. All the methods referred to involve the use of principles of general application, so that although these methods are applied to the manufacture of parts of machine tools, they could be utilized with equal success in plants handling various other classes of work.

Planing the Legs of Springfield Lathes on the Shaper

Engine lathes and shapers are built by the Springfield Machine Tool Co., of Springfield, Ohio, and in this firm's plant it is the regular practice to use shapers of their manufacture for planing lathe bed legs. In Fig. 1 a Springfield shaper is shown equipped for this operation, and it will be seen that the table has been removed so that a fixture *A* may be bolted to the saddle, this fixture being of much the same shape as the lathe bed legs. There are two projecting feet *B* on which the casting rests until it has been secured in place.

The cast-iron member *C* of the clamping mechanism carries three hardened plugs (two of which are shown at *D*); these plugs are held in contact with the lathe bed leg casting by three bolts *E*, thus clamping the casting in place on the fixture. The simplicity of the arrangement makes it possible to employ apprentices to do work for which high-priced mechanics might otherwise be required. These lathe bed leg castings are generally rather hard, and for that reason the cutting speed is kept within conservative limits, so that the figures given in the following do not represent maximum production. The cutting tool is carried by a holder and located behind the point of support, as it has been found that a tool of this type gives better results than are obtained with a straight one.

In machine tool building plants, as in many other shops engaged in the manufacture of metal products, there are numerous operations for which the shaper is well adapted. The following article describes methods that are employed in tooling up and operating shapers for such work in plants building lathes, milling machines, grinders, planers, and other types of machine tools. The examples selected are sufficiently general in their scope to suggest applications of similar principles and methods in plants that are engaged in the manufacture of a variety of products.

In planing these lathe legs, the work consists of taking roughing and finishing cuts. There are two surfaces to be planed at the top of the work; on a 16-inch lathe, these surfaces measure 12 inches long by 3 inches wide. A round-nosed, high-speed steel tool is used for taking the roughing cut at a speed of 50 feet per minute, with a feed of 0.011 inch per stroke, and a depth of cut of about 1/8 inch. The finishing cut is taken with a round-nosed, stellite tool of a greater radius of curvature than the one employed for roughing. This tool is operated at the same cutting speed, but with a feed of 0.008 inch per stroke and a depth of cut of about 1/16 inch. Approximately one-half hour is required to set up and plane a casting by the method described.

Facing Bosses on American Lathe Lead-screw Supports

A rather simple surfacing operation is shown in Fig. 2, which illustrates the use of a 16-inch shaper made by the American Tool Works Co., Cincinnati, Ohio. The operation consists of rough- and finish-planing a circular boss *A* on the lead-screw support for American engine lathes. A roughing cut is taken with a round-nosed tool at a speed of 45 feet per minute, using a feed of 0.032 inch, and leaving 0.006 inch of metal for removal by the finishing cut, which is taken at a speed of 45 feet per minute, with a feed of 1/2 inch. The production time on two pieces of work which are set up for simultaneous machining is ten minutes.

The method of setting up the work is the point of particular interest in this job. As the castings come to the machine, they have been planed on their under side, forming a finished right-angled shoulder that is located against the corner of the shaper table. The two pieces of work are held against the side of the table by means of a bar *B*, which passes through cored openings in the castings and is drawn toward the table by means of clamping bolts (not shown in the illustration). The work is held down on top of the table by straps *C*. The thrust of the cutting tools is taken by an end-stop *D*.

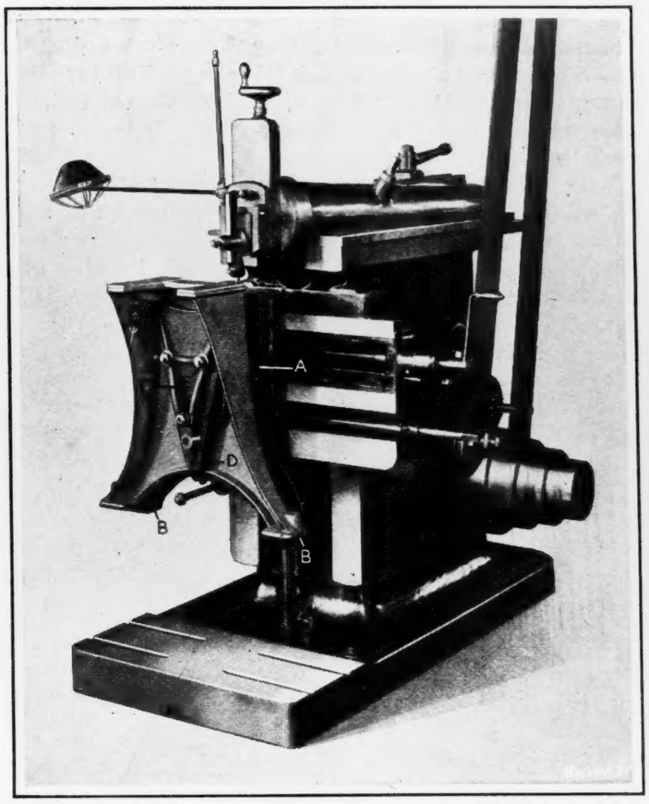


Fig. 1. Shaper equipped for a Short Planing Operation on the Legs of an Engine Lathe

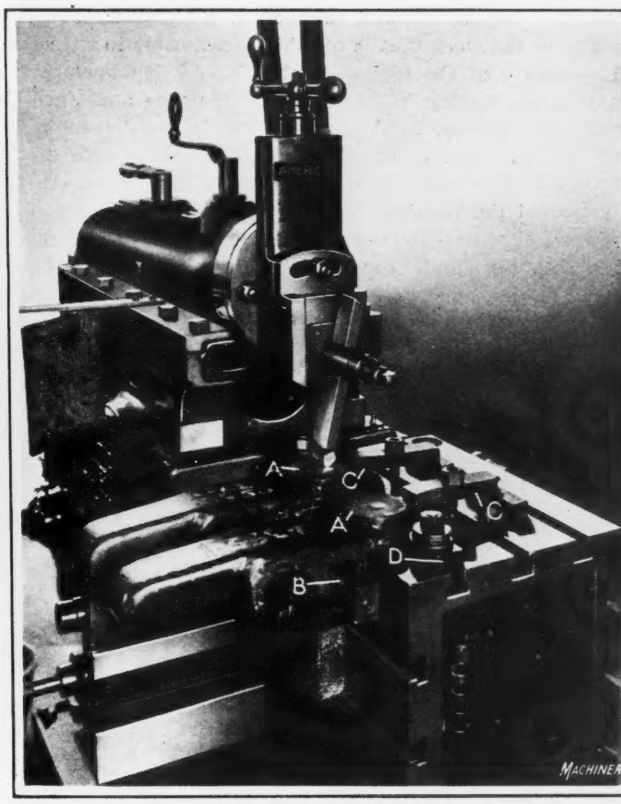


Fig. 2. Shaper equipped for planing the Faces of Bosses on Screw Supports for Engine Lathes

Planing Steptoe Milling Machine Knees on the Shaper

In machining knees for hand milling machines built by the John Steptoe Co., of Cincinnati, a practice is made of planing the dovetailed bearing for the saddle, with the work set up on one of the shapers of this company's manufacture. As the castings come to this máchine, the back of the knee has been planed so that it may be used as the locating surface. The table is removed from the shaper and the milling machine knee to be planed is clamped directly to T-slots in the apron. This operation, as shown in Fig. 3, consists of planing the dovetailed bearing for the saddle on the knee, roughing and finishing cuts being taken, as in the preceding cases, with the standard forms of tools employed for this purpose. This is a regular production job in the Steptoe plant.

Shaping Queen City Grinder Driving Shaft Brackets

On grinding machines built by the Queen City Machine Tool Co., of Cincinnati, the main driving shaft located at the back of the machine is supported by brackets of the form shown set up on a shaper table in Fig. 4. While held in this way it is required to plane surface *A* on the casting. An interesting feature of this job is the provision made for holding pieces of work that are of rather an unusual form. The work is held in an offset jaw vise mounted on top of the shaper table, and an auxiliary bracket *B* is bolted to the finished side of the table to support the bearing boss, which would otherwise overhang and cause severe vibration while the cutting tool is at work. The upper part of the casting is further supported by a jack-screw *C* that is furnished with lock-nuts, so that it may be raised under the

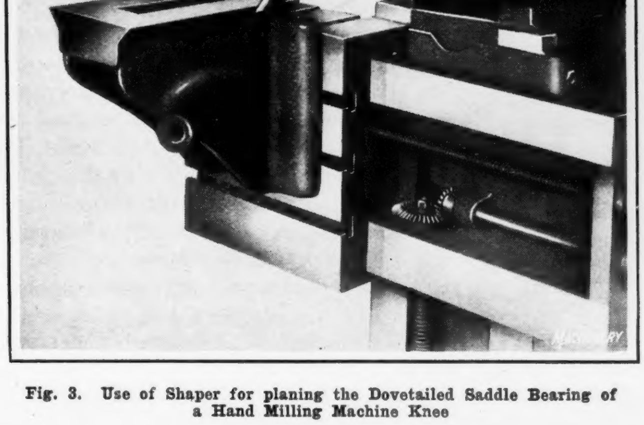


Fig. 3. Use of Shaper for planing the Dovetailed Saddle Bearing of a Hand Milling Machine Knee

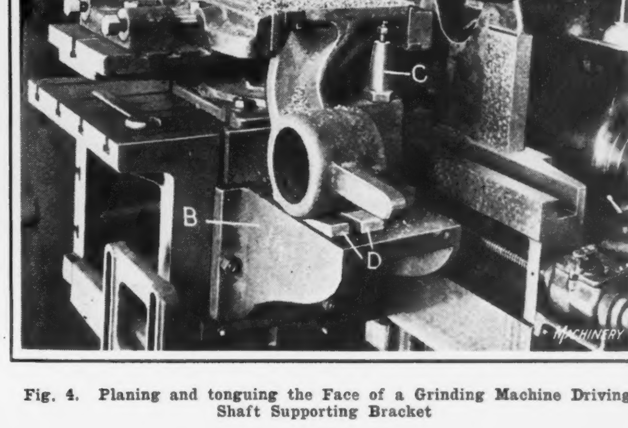


Fig. 4. Planing and tonguing the Face of a Grinding Machine Driving Shaft Supporting Bracket

corner of the casting and clamped in position to support a section of the work that is too thin and flexible to withstand the pressure of the tool without this additional support.

After the casting has been set in the vise and lined up ready for planing, hard wood wedges *D* are driven in between the surface of bracket *B* and the under side of the bearing boss, in order to afford a secure foundation. In the illustration the roughing cut is being taken on the face of the bracket with a round-nosed tool. The sequence of operations is quite simple, consisting of the planing of this face of the casting and the forming of a tongue that fits into a corresponding groove planed in the bed of the grinding machine. After the roughing cut has been completed, a finishing cut is taken with a square-nosed tool. The tongue is finished to the required width with a duplex tool which straddles the tongue and simultaneously finishes its two sides. The operation is performed on a 28-inch Queen City shaper and takes twenty-one minutes.

Shaping Front Plates for American Planer Frictions

In Fig. 5 is shown the work of planing a piece known as the "front plate" for an American planer friction. As the work comes to this shaper, it has been faced on the under side, and a fixture of the form shown is employed, because there is a boss on the bottom of the work, for which a clearance space must be provided in the fixture; otherwise, it would be practicable to strap this piece directly to the shaper table. The job consists of rough- and finish-planing the horizontal surface which surrounds the dovetail bearing, and also rough- and finish-planing the bearing. As the shoulder at the end of the dovetail makes it impracticable to handle more than one piece of work at a time, it is not possible to apply the principle of setting the work up in a string for planing, and consequently this may be regarded as a production job for which the shaper is particularly adapted.

At best, the planer could operate only on one piece at a time, for the reasons mentioned, and the positive stroke control of a shaper is a desirable feature when the tool traverses almost into contact with a shoulder on the work, as in the present case. This job is done on an American 24-inch shaper. At the back of the fixture on this machine is a tool-setting gage *A* used in setting the tools for operation on both the horizontal top face of the work and on the inclined surfaces of the dovetail. The method of procedure is first to rough the top face with a round-nosed tool, and then take a finishing cut with a broad square-nosed gooseneck tool.

Next, a dovetail roughing tool is used for taking the first cut on the inclined faces of the bearing, after which a finishing tool is substituted for the final operation. The dovetail bearing is required to be accurate within 0.001 inch. For testing the work after the finish-planing operation, a gage *B* is used, which is coated with a thin film of red lead and inserted in the bearing in order to test the accuracy of the form and the straightness of the inclined sides. All operations are performed at a cutting speed of 55 feet per minute. On the horizontal surface, the feed for roughing is 1/8 inch, and for finishing 3/4 inch; on the inclined faces of the dovetail, the feed for the roughing cut is 0.020 inch, and for the finishing cut 0.250 inch. There is an allowance of 0.006 inch of metal for the finishing cut. On this job an operator can finish five pieces in eight and three-quarter hours.

Fig. 5. A 24-inch Shaper equipped for planing the Dovetail Bearing and the Horizontal Face of Front Plates for Planer Frictions

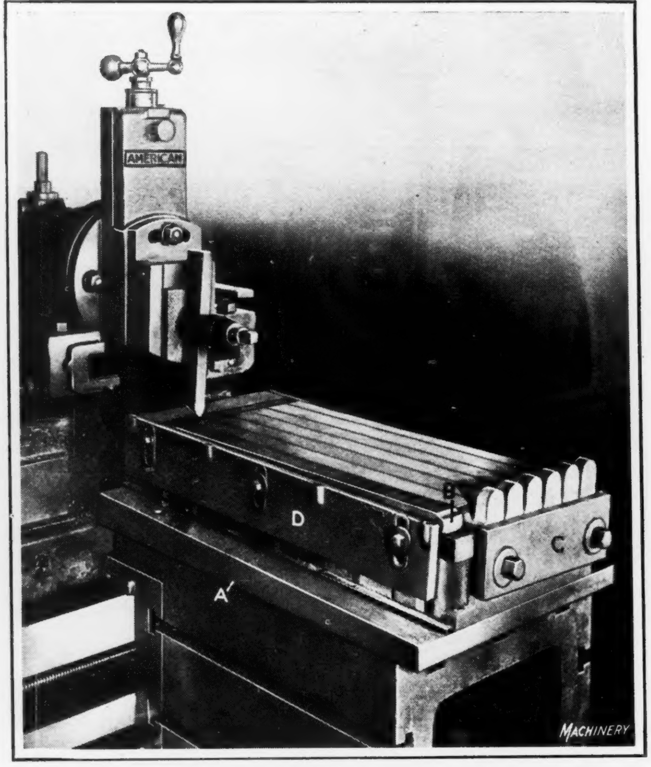


Fig. 6. A 24-inch Shaper equipped for planing the Tapered Face of Gibs held on a Magnetic Chuck

Planing Tapered Gibs on a Shaper

In the plant of the American Tool Works Co., 24-inch shapers of this company's manufacture, which are equipped with magnetic chucks as shown in Fig. 6, are used for taper planing operations on various types and sizes of gibs employed in the construction of American machine tools. The sides and straight under side of the gib are machined before the work is set up for planing the tapered side. It will be seen that six gibs are set up on the magnetic chuck at one time. In order to obtain the required location for the taper planing operation, a master plate *A* is placed between the shaper table and the chuck; this tilts the chuck to the proper angle, so that horizontal strokes of the shaper tool will result in planing the top face of each gib at the required taper to the previously finished lower side.

These gibs are required to be accurate, after finish-planing, within 0.001 inch from end to end. Hence it is important to set up the magnetic chuck on the tapered foundation plate *A* in such a way that the angle of the work will be brought within the required limits. For checking the set-up

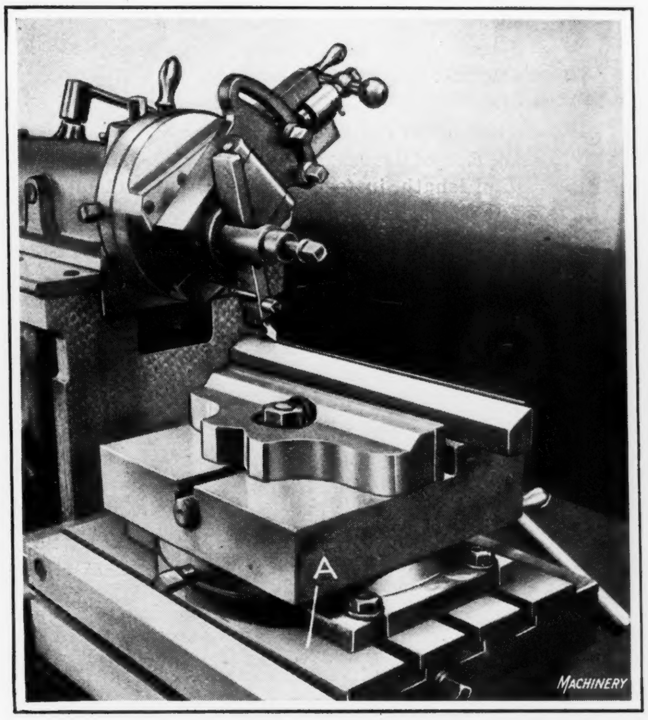


Fig. 7. Method of planing Double-angled Gibs

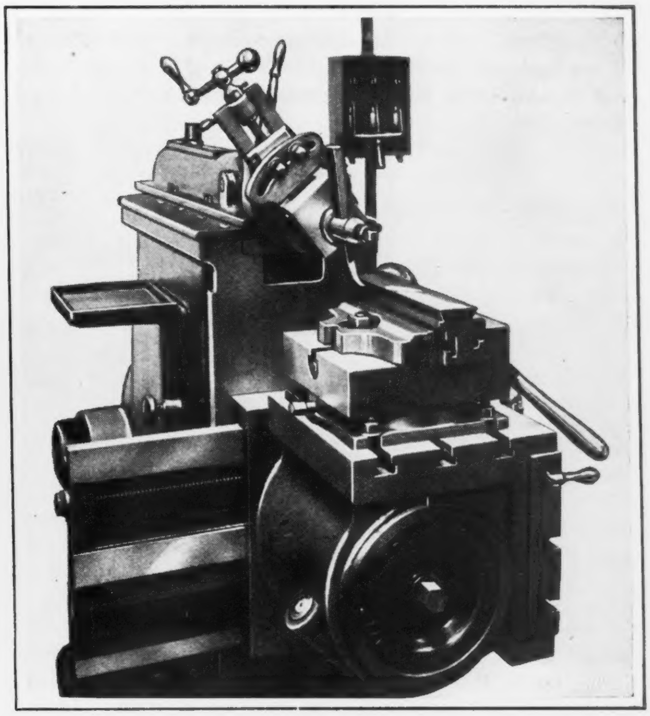


Fig. 8. Planing Inclined Side Faces of Dovetailed Slide Bearing

before planing, a master gib *B* is used, which is placed on the face of the magnetic chuck, a dial indicator being mounted in the shaper toolpost. This master gib is accurately planed, so that if the chuck has been properly set up, the indicator will give a uniform reading from end to end of the gib *B*. Any error which is discovered in making this test is corrected by placing one or more sheets of packing paper between the shaper table and the plate *A* at the low end. Then the operator can set up six of the gibs ready to be planed.

Provision for Supporting End Thrust

The magnetic chuck is furnished with an end plate *C* and a side plate *D* for the double purpose of assisting in locating the work against its previously planed side faces, and of supporting the end thrust of the tool that could not be carried by the holding power of the chuck. A roughing cut is taken over the work with a round-nosed tool, using a cutting speed of 55 feet per minute with a feed of 0.035 inch. For finishing, a round-nosed tool is used, the end of which has been slightly flattened by rubbing it down on an oilstone. This tool is also operated at a cutting speed of 55 feet per minute with a feed of 0.030 inch.

With an equipment of this kind, the setting fixtures may be depended upon to hold the work within accurate limits, after the original set-up has been made by an experienced mechanic. Consequently, it is found economical to employ a semi-skilled operator on this job, and it is for that reason that the finishing cut is taken with a tool of the type described. Otherwise, it would be regarded as better practice to employ a broad square-nosed finishing tool of the goose-neck type, with a feed of from ½ to ¾ inch per stroke. The production time for the rough- and finish-planing operations on the tapered side of six gibs is thirty minutes.

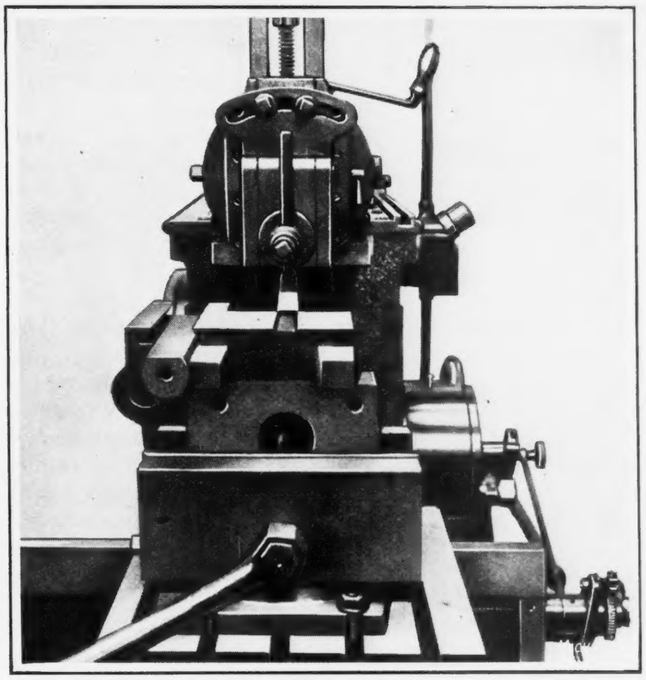


Fig. 9. Use of a Broad Square-nosed Tool for planing a Shallow Slot in the Work

Shaping a Gib Having a Double Taper

Fig. 7 shows how a shaper of the type made by the Potter & Johnston Machine Co., Pawtucket, R. I., can be utilized for machining a piece of work on which there is a double angle. The piece shown in process of manufacture is a tapered gib on which a 45-degree angle is required to fit the dovetailed bearing of the slide, while the usual lengthwise taper is also provided. On shapers of this company's manufacture there is a tilting flap (shown at *A*) at the top of the table, which can be raised to any required angle in order that the surface of the work being machined can be planed at any desired angle with the lower surface of the work that is clamped to the table. It is this application of the tilting flap that provides for obtaining the lengthwise taper on the work; and by setting the tool-head at an angle of 45 degrees, the single-point tool may be fed down the inclined side of the work, thus obtaining the desired form.

Shaping the Angular Sides of a Dovetailed Slide

Fig. 8 shows the method used in shaping the angular sides of a dovetailed slide bearing on a Potter & Johnston shaper. This job is similar to the one illustrated in Fig. 7 in so far as the planing of the 45-degree angular sides is concerned. It will be noticed that the tool-head is set at an angle to give the desired form to the work, but there is one noteworthy difference in this case, which is that the tool is required to cut on the under side of the inclined face instead of at the top. Consequently, the tool had to be

forged with an offset on which the cutting point is ground, so that there will not be any interference between the side of the tool and the work. In Figs. 7 and 8 it will be seen that the pieces to be machined are secured in an ordinary shaper vise.

Cutting a Tongue-slot with a Shaper Tool

Fig. 9 shows a Potter & Johnston shaper on which the dovetailed bearing for a slide has just been machined at the setting illustrated. After completing this part of the work, the table is moved over to provide for cutting a tongue-slot; the tool is shown engaged in the performance of this operation in the illustration. For this job, the tool is made of the proper width to take the cut with only a vertical feed movement.

* * *

LENGTH OF ROPE FOR DRUMS

By G. W. TREWHELLA

The formulas given on page 768 in MACHINERY, April, 1921, for finding the length of rope that can be wound on a drum, appear to give results that are too high. One important point not taken into consideration in the previous discussion is that when a rope is wound on a drum the direction of the helix changes with every added layer so that the rope in the second layer will not lie in the groove between the coils of the first layer but must lie across these coils at an angle. This will make the distance between layers nearly equal to the diameter of the rope, so that for practical purposes it is allowable to use the diameter of the rope as the radial pitch of the coils.

The number of coils in a layer will be one less than the width of the drum divided by the diameter of the rope, which will be evident when considering the winding of a rope 1 inch in diameter on a drum 2 inches wide. There is room for but one coil in a layer if the rope forms a true helix. The coils in successive layers will be seen to cross every time at a point opposite the starting point. This will make the increase in radius per layer less than the diameter of the rope at the starting point of a coil, and equal to it at a point opposite the starting point, making each added coil eccentric relative to the first. For such a condition the diameter of the rope must be taken as the radial pitch of the coils, or the most eccentric side will project beyond the flanges. It will also be seen that if the drum is increased from 2 inches to $2\frac{1}{2}$ inches in width, there will be room for $1\frac{1}{2}$ coils under the same conditions, so that it is not "impossible to have a fraction of a coil," as stated in the former article.

In the case of the $1\frac{1}{2}$-coil condition, the coils will cross at opposite sides in alternate layers, so that a dimension slightly less than the diameter of the rope should be used as the radial pitch of the layers. On a drum having a small number of coils per layer, there will be an error in the true helix, but on a longer drum any variation from the true helix will be very slight. In practice, it is not likely that eccentric windings will cause trouble.

The following formulas contain certain theoretical errors which are believed to be immaterial for most practical purposes. No account is taken of the extra length due to the helix of each coil; of the extra fraction of a coil in each layer due to the wedging action against the flanges; or of the rope lying in the groove of the under layer during a part of each coil. The last error works both ways, as it will in some cases allow an extra layer, but will slightly shorten each coil owing to its shorter radius when in the groove. It is only under very favorable conditions that a large number of layers is wound close enough to crowd more rope on the drum than the following formulas indicate; furthermore, for a few layers the errors are so minute that it is believed these formulas will answer the purpose in all ordinary cases.

In the following formulas,

d = diameter of rope, in inches;
D = diameter of drum, in inches;
F = diameter of flange, in inches;
W = width of drum, in inches;
N = number of layers;
O = total length, in feet, of rope in one coil taken from each layer;
Q = number of coils per layer;
L = length of rope, in feet, that can be wound on the drum = OQ

Then

$$N = \frac{F - D}{2d}$$

This formula gives the number of layers to the nearest whole number, unless it is not allowable for any part of the rope to project beyond the flanges of the drum. If such is the case, the fractional remainder should be dropped and the whole number used. If the diameters of the drum and of the flange are considered as the inner and outer circles, respectively, of a ring, the area of this ring may be used to obtain the value of O; thus,

$$O = \frac{0.7854\,(D + 2Nd + D)\,(D + 2Nd - D)}{12d}$$

$$= 0.2618N(D + Nd)$$

$$Q = \frac{W}{d} - 1$$

$$L = OQ = 0.2618N(D + Nd) \times \left(\frac{W}{d} - 1\right)$$

Applying the formulas to the conditions stated in the previous article in which the diameter of the drum equals 12 inches, the width 6 inches, the diameter of the flange $18\frac{1}{2}$ inches, and the diameter of the rope $\frac{3}{8}$ inch, we have:

$$N = \frac{18.5 - 12}{2 \times 0.375} = 8\ 2/3 \text{ or, say, } 9 \qquad Q = \frac{6}{0.375} - 1 = 15$$

Then,

$$L = 15 \times 0.2618 \times 9\ (12 + 9 \times \tfrac{3}{8}) = 543.4 \text{ feet}$$

as compared with 620.5 feet, obtained from the previously published formula.

In the second case the drum is widened $\frac{1}{4}$ inch, and the other dimensions remain as before, so that $N = 9$ and $Q = (6.25 \div \frac{3}{8}) - 1 = 15\ 2/3$.

Then

$$L = 15\ 2/3 \times 0.2618 \times 9\ (12 + 9 \times \tfrac{3}{8}) = 567.5 \text{ feet}$$

as compared with 640.6 feet, obtained from the previously published formula.

When the flange is reduced to $18\frac{1}{8}$ inches, and all the other dimensions are the same as in the first example,

$$N = \frac{18.125 - 12}{2 \times 0.375} = 8\ 1/6 \text{ or, say, } 8 \qquad Q = 15$$

Then,

$$L = 15 \times 0.2618 \times 8\ (12 + 8 \times \tfrac{3}{8}) = 471.2 \text{ feet}$$

as compared with 548.4 feet, obtained from the previously published formula.

The only piece of rope available for checking these formulas was a reel containing 5000 feet of wire rope, $2\frac{1}{4}$ inches in circumference. The values used in checking the formulas were $D = 14$ inches; $W = 29$ inches; F = from 40 to 41 inches; and $d = 0.75$ inch. It was not practicable to test the concentricity of the windings, owing to the small hole in the end of the reel, but the larger value of F was used as representing the required diameter of a flange to support the rope. This was new rope, wound evenly on the reel, closer than would be the case in average usage. The formulas here presented give the length as 4881 feet, while the formulas published in April MACHINERY give the length as 5388 feet.

Selling Machine Tools

By a Machine Tool Sales Manager

As nearly as the writer has been able to determine, there were in the spring of this year approximately 1400 salesmen in the great manufacturing section of the United States east of the Mississippi and north of the Ohio and Potomac Rivers devoting their entire time to the selling of machine tools. This figure includes the members of firms dealing in machine tools who devote their time to selling, their outside salesmen, their store salesmen, and the direct selling representatives of machine tool manufacturers, as well as sales correspondents. It excludes service men, demonstrators, and those officials of machine tool firms and their assistants whose work is business routine rather than direct sales work.

On the Pacific Coast and in the southern states there are a great many machine tool salesmen, but in those sections there are probably not more than fifty who devote their entire time to the closing of sales agreements relative to machine tools. In those parts of the country the relative scarcity of machine shops requires the salesmen to handle more lines than machine tools only, thereby dividing their sales efforts. These salesmen usually sell supplies and equipment for woodworking and mining, and also handle contractors' machinery, in addition to machine tools. Were these "part-time" salesmen included, as well as those members of machine tool firms who are not directly active in the selling organization, the total number of men engaged in the distribution of machine tools in the United States would be in the neighborhood of 8000.

Tendencies in the Selling of Machine Tools

There is a rapidly growing tendency in industry in general for the manufacturer to get closer to the point of sale. In the machine tool industry this tendency is indicated by the rapid increase in the number of manufacturers who have their own selling organizations and salesmen and who deal directly with the consumer. It is also indicated by the number of sales engineers, district representatives, and special representatives traveling through the country for concerns who continue to distribute their machines through dealers.

In the distribution of some commodities, such as food products for example, a direct distribution system eliminates time and waste and results in a lower price to the consumer. This, however, does not apply to the machine tool industry. In the majority of cases manufacturers of machinery are not so much impressed by the economy of direct distribution; they are mainly interested in cutting down the distance between themselves and their customers in order that they may keep in closer touch with the trade. They desire to observe tendencies, combat harmful influences, and watch the effect of their sales and advertising work. The machine tool salesman enjoys the unique distinction of knowing the mechanical phases of the business almost as well as the manufacturer whom he represents. He is therefore able to pass on information that the manufacturer otherwise would find difficulty in obtaining.

Apart from this close contact with the trade, there is perhaps less to be gained in the machine tool industry from direct dealing with the customer than in other industries, and the question as to whether machinery house salesmen or manufacturers' direct salesmen are to be preferred is a question that must be settled individually. It depends to a considerable extent upon the product, the locality, and the machinery dealers in the territory under consideration.

Characteristics of Machine Tool Salesmen

Whether employed by a machinery dealer or by the machine tool manufacturer, the machine tool salesmen generally possess unique characteristics. They occupy a class by themselves in the selling profession. In knowledge and training in the business which they represent, machine tool salesmen can confidently challenge those of other industries. The majority of machine tool salesmen obtain their early training in machine tool plants and later branch out into the selling department, either as representatives of their own company or of machinery dealers. Many have developed into salesmen from minor positions within the organizations of machine tool dealers, and only a few have come into the field from industries not connected with the machine tool business.

Another characteristic of the machine tool salesman is that he seldom has sold any other product. The fact that he so largely originates from within the industry accounts for some of his distinguishing methods. The machine tool salesman depends almost exclusively upon his mechanical knowledge in his sales work. He knows the goods more thoroughly and gives to his customers and prospects a greater amount of definite and valuable information than the salesman in practically any other line of industry. The machine tool salesman also, in the course of his work, absorbs and is able to later distribute a great fund of mechanical information. On the other hand, he does not seek and is somewhat slow to absorb and practice many points of salesmanship that could be advantageously used.

The Salesman's Position Today

There are times when the business relations between the manufacturer and the customer in all industries need to be carefully handled. This is true of the machine tool industry as well as of any other industrial field. The late inflated period was to no man's liking. There are instances in it that are stamped upon our memory. The object of our late wrath may have been the landlord, or the butcher, or we may have a mental waiting list of those that were paid a higher price than we considered reasonable. In the excitement of boom times we paid what we were asked, reserving only the determination to even matters up in some way when the opportunity presented itself.

As a matter of fact we are justified in harboring a feeling of resentment in but few instances. The seller of articles or products at what we termed exorbitant prices was himself caught in the same whirlwind of economic conditions. Few understood or understand now these economic conditions. The average buyer of machine tools does not dig deeply into the study of economics—it is apart from his regular line of duty, and it is a very dry pastime. However, the position and the policy of the machine tool builders during the period of inflation was, as a rule, exceptional, and it is the machine tool salesmen's opportunity to capitalize that position. He need not be an economist in order to be able to represent fairly the machine tool manufacturer's position, and he can employ his opportunities as a salesman to gain advantage in giving accurate information as to the relation of costs and selling prices during the entire period of inflation. In this way he can safeguard his industry as well as gain greater results from his sales efforts. In articles to follow the writer will dwell in greater detail upon some of these points.

DECEMBER, 1921 MACHINERY VOL. 28 NO. 4

PUBLISHED MONTHLY BY THE INDUSTRIAL PRESS, 140-148 LAFAYETTE ST., NEW YORK

ALEXANDER LUCHARS, PRESIDENT
MATTHEW J. O'NEILL, GENERAL MANAGER
ROBERT B. LUCHARS, SECRETARY

LONDON: 52 CHANCERY LANE
PARIS: 121 RUE LAFAYETTE

ERIK OBERG, EDITOR
FRANKLIN D. JONES, ASSOCIATE EDITOR
EDWARD K. HAMMOND, WESTERN EDITOR

HOW PRODUCTION COSTS ARE REDUCED

October and November MACHINERY presented numerous practical examples of cost-reducing methods, particular attention being directed to the necessity for a careful study of present shop practice in order to determine the possibilities for substantial cost reductions through the use of more efficient methods and equipment.

In this number the educational campaign is continued. Specific examples are mentioned here only to emphasize to mechanical executives the importance, in these rapidly changing times, of keeping abreast of the new machines, tools, methods and processes which automatically bring down manufacturing costs. These new tools and new ways of doing things cover a wide range of shop practice and are applicable in all branches of the metal-working industry.

The article in this number on reducing costs in the assembling department is typical in giving ideas and suggestions that may be profitably studied. The cost-reducing tooling equipments for automobile work described in two different articles show principles that may be applied with equally satisfactory results to any line of manufacture where the quantity is great enough to permit the use of such methods. Other articles refer to efficiency and lower costs obtained through careful study of drilling problems and of combination die design. The value of the die-casting process for reducing costs is more and more being recognized, and an article on this subject gives comparative costs on making certain parts by former methods and by die-casting.

The great need is for more radical thought in regard to equipment and methods. Because a method used for years proved satisfactory in days when cost was relatively unimportant, when more orders could be had than the factory could fill, it is far from certain that the same methods will serve today when price is almost the chief consideration.

* * *

THE NEW BASES FOR ADVANCEMENT

Jobs are not so plentiful as they were, and they will not be back to the heyday of 1917, 1918 and 1919 for many moons to come. The fevered period of war production ended long ago, and the day when any good-for-nothing could get a job has passed. The amazing labor replacement, which was as high as 70 per cent in many industries, no living man may see again. A job, almost any kind of job, has taken on greatly increased value. The better jobs are scarcer than at any time in twenty years, and hereafter it will take more knowledge and ability to get those jobs and hold them than ever before. Manufacturers are endeavoring to reduce their production costs to meet the keen competition for orders that is here now; machinists, toolmakers, draftsmen, machine designers, foremen, works managers, are also facing a period of keen competition—for jobs.

Prices have been reduced; costs must follow. Greater production for the dollar expended in the plant will force the elimination of every factor below the most efficient, and the human factor cannot hope to escape this inevitable readjustment. A great many designers, foremen and men higher up in the mechanical world have lost their places for good, but many of them do not know it yet; nor do they realize that there is a new deal in industry, that credentials which were satisfactory years ago will not do now. The world is demanding new men as well as new methods, men who are energetic, alert, better equipped, eager to win their way to the top, keen to note the new bases in industry.

Useful knowledge will be more important than ever before. Successful men are always great students. It is knowledge and character that advance a man, and now the tests are more severe. Success is won, not at the movies or in any of the other primrose paths of dalliance, but in the faithful hours of study and preparation for the bigger job ahead. Merchants and manufacturers are keenly watching for the men who are to carry on—to take up their burdens, as they took up the burdens of those who preceded them. Upon these men depends America's place in a world battling for industrial and commercial supremacy—which means everything else. It is a direct and ringing challenge to the men, especially the younger men, in the mechanical industries of America. Industry demands the best they have.

Every field has developed and more or less systematized a body of literature, a fund of craft data, available for the earnest worker determined to make his way up the ladder of success. It is a great treasure house in which is stored the priceless data worked out by generations of men in the exacting school of practical experience. Unless he masters this educational material and makes it his own, the worker in the engineering field is not equipped for advancement and responsibility and he will fail when the tests come. The data are there, the educational facilities are available for any man who can read and think. It is up to him. Unless he is willing to make the effort he must be content with a humble place in the ranks.

* * *

INTEREST IN STANDARDIZATION GROWS

In his address before the National Machine Tool Builders' Convention, the president, A. H. Tuechter, strongly emphasized the importance of machine tool builders taking more active interest in the work of standardization, and pointed out that if the machine tool builders did not voluntarily standardize such of their products as lend themselves to uniform design, engineering bodies representing the users of machine tools would be likely to take up this work, to the disadvantage of both manufacturer and user.

The American Gear Manufacturers' Association has done some excellent work in connection with the standardization of gearing. A comprehensive plan, covering all classes of gearing, has been laid out; and, step by step, each of the details making up this plan is studied by committees composed of men having the training needed for handling each particular detail. The standards accepted by the society are in many cases agreed upon by cooperation with the American Society of Mechanical Engineers and the Engineering Standards Committee, which acts as a clearing house for all standardization work in the United States.

It is evident to every manufacturer that standardization is one of the most important factors in cost reduction, and without question it will be applied more generally to manufactured products in the near future. Builders and users of machinery will be the first to benefit, but the general public will also profit in greater measure through the decrease of manufacturing costs. In Germany the engineering profession is now engaged in important standardization work, and our competitive strength in the world's markets will largely depend on our ability to keep abreast of the advances made there and in other manufacturing countries.

Reduced Prices of Machine Tools

THERE has been a decided reduction in the prices of machine tools during the past year, and those who are thoroughly familiar with the machine tool industry believe that further reductions can be expected only in exceptional instances. The reductions that have been made have not been uniform for all classes of machine tools, because the conditions governing the manufacture of different lines and types vary. Furthermore, the increases in prices in the last seven years have varied considerably for different types. There are some purchasing agents who seem to believe that machine tool prices should return to the 1914 level, but those who expect this are not familiar with the conditions in the machine tool industry and the reasons why it would be impossible to conceive of any return to the 1914 price level.

In February, 1921 MACHINERY, a thorough analysis was published of comparative machine tool prices in 1914 and 1921. Since that time conditions have changed somewhat. In many respects they have become more stabilized, and it is possible to show definitely why a return to pre-war prices in machine tools is impossible. In fact, even a near approach to the pre-war price is not to be expected. As machine tool builders appear to have some difficulty in obtaining orders even where the machines are needed at the present time, because some purchasers insist upon prices more nearly like those of 1914, it might be well to point out a few of the conditions prevailing in the manufacture and selling of machine tools, for the information of buyers who have not taken these conditions into consideration.

The 1914 Price Level

As pointed out in the article in MACHINERY previously referred to, the prices in 1914 were so low, because of extremely keen and ruinous competition, that they returned no profit. The prices at that time were too low to support the industry permanently. The competition due to the industrial depression at that time had forced manufacturers to accept prices that did not cover all their costs, and it was not until two years later—in 1916—that prices had risen to a level where a profit sufficient to sustain the industry permanently was obtained. The figures of a well-known manufacturer show that if the 1914 prices had been based upon costs with a fair profit, they should have been about 40 per cent higher than they were at that time. To expect prices to return to a level that even previous to the war did not produce sufficient profit to sustain the industry is evidently impossible.

Wages and Taxes in 1914 and 1921

It should not be necessary to point out to anyone familiar with industrial conditions that wages are permanently on a higher level than they were in 1914. Even in the industries, like the iron and steel industry, where wages have been most drastically cut, the rate for unskilled labor is now 50 per cent above the pre-war rate, and for skilled labor it is still higher. In addition to this, working hours are shorter now than before the war, and are likely to remain so, which means that there are added costs on that account.

It has been pointed out by many who have studied the history of wages that the wage rate never goes back to the same low point from which it has once started to rise, and therefore there is no reason to believe that machine tool builders will ever again be able to hire skilled machinists for 25 or 28 cents an hour, which was the rate commonly paid in many machine tool centers previous to the war.

The national taxation program due to the war, and the increased state and municipal taxes made necessary by the conditions created by the war, comprise a very important part of the cost of all products, and cannot be eliminated in determining upon the selling price. The influence of taxes upon price will continue to be an important factor of costs for many years to come, because we have an enormous national debt to pay, the interest of which alone is twice our largest national budget previous to the war. Any business man who thinks that business can be carried on without passing the taxes on to the consumer ignores one of the fundamental facts in economics, because a manufacturer must, out of his production, obtain a return over all expenditures, including taxes, or he will not be able to stay in business.

The Effect of Increased Freight Rates

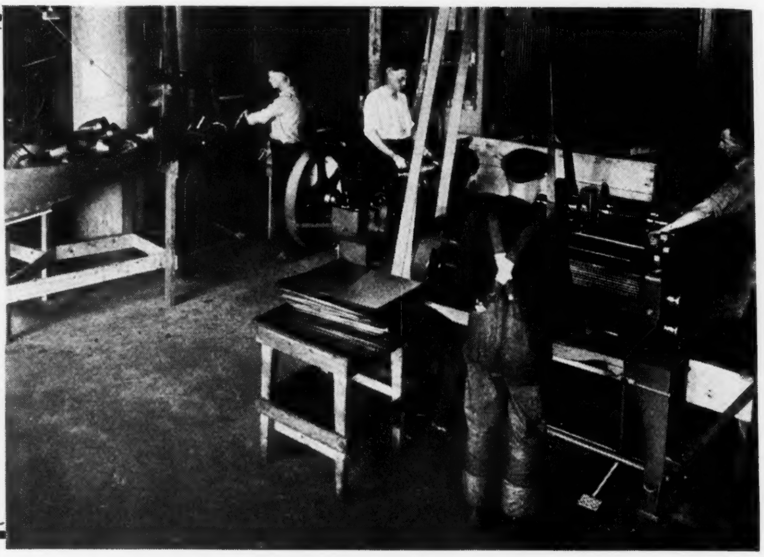
Another element that enters into cost calculation all along the line is that of freight rates. Generally speaking, freight rates have been increased from 100 to 120 per cent on the materials and the finished products of the machine tool industry. Reductions in freight rates are desirable, but by necessity it must be quite a while before they can be materially reduced. If they are suddenly reduced to the detriment of the railroads, this will, in turn, react unfavorably upon the metal-working industries, because the railroads are big purchasers of the products of these industries; so that no matter how desirable it is that freight rates be reduced, it is even more important that the efficiency of railroad labor be increased and an equitable adjustment made in railroad wages, and this cannot be done suddenly. The transportation element, therefore, will continue to increase the cost of manufacturing for a long time to come.

Improvements Made in Machine Tools

In addition to all the factors mentioned, there is the fundamental one to be considered that all machine tool builders have greatly improved their product during the last seven years, so that even if there had been no abnormal price advance due to conditions created by the war, there would by necessity have been an advance in price due to the improvements in the product. This was specifically pointed out in the article in February MACHINERY, where reference was made to a machine that weighed 15,200 pounds in 1914, and which now, redesigned, weighs 19,000 pounds. Not only was the weight of this machine increased so as to afford increased strength and capacity for greater production, but the speed was also increased nearly 100 per cent, and the power from 8 to 20 horsepower. These changes necessitated gears made from higher grade material, properly heat-treated, and the material in some parts had to be made from steel costing three times as much as the material formerly used. The machine is known by the same designation as to size and other characteristics as it was seven years ago; yet no reasonable buyer would expect to purchase it for the same price even if there had been no other factors increasing costs and prices in the last seven years.

In comparing 1914 and 1921 prices, the factor of improved design should be particularly emphasized. The machines sold today are heavier, their capacities greater, they have more power and speed, they are made from better material, and they will therefore last longer and produce more. There are also many attachments provided that were not provided in the past. No such comparisons can be made in regard to clothing, shoes, sugar, or numerous other commodities which should be more likely to return to the pre-war price level than machine tools; these are an entirely different class of manufactured products.

Making One-piece Corrugated Elbows



Machines Employed for the Performance of Corrugating, Forming, Compressing, and Bending Operations

BY separating the manufacture of one-piece corrugated stove-pipe elbows into a series of logical steps and designing a machine for performing each of these, the Niagara Machine & Tool Works, Buffalo, N. Y., have succeeded in building an equipment which produces elbows that are uniform in diameter, accurately bent to a right angle, and have tight throat seams and evenly spaced corrugations. Only four machines are required for producing the bent and corrugated elbows from blank sheets of metal, and by grouping these machines as shown in the heading illustration, the transportation of parts between the machines is eliminated, and a minimum amount of labor is required for maximum production. The process is such that the metal is not stretched along the outer curve of the bend, and hence its strength is not decreased nor the surface broken, the latter being a condition that mars the appearance and hastens corrosion.

Corrugating the Sheets and Rolling into Pipe Form

The blank sheets from which the elbows are formed may be purchased trimmed to the correct size, or they may be cut and squared by means of a squaring shear, a 30-inch machine of this type being satisfactory for the purpose. In the first operation, these blanks are fed between the two corrugating rolls of the machine illustrated in Fig. 1, which revolve at the rate of 20 revolutions per minute. Each sheet is placed on the table and properly positioned relative to the rolls by means of front and side gaging strips. When the foot-treadle is depressed, the sheet is automatically fed through the rolls. The number of corrugations produced can be varied to suit the different sizes of elbows. Offsets are formed in the corrugations along one edge of the sheet, which insures a close lap joint in the finished product. A piece of work, after having been operated on by this machine, is shown in the lower right-hand corner of the illustration.

In the next operation the sheets received from the corrugating machine are run through the machine shown in Fig. 2, the sheets again being aligned on the table by means of gaging strips while the upper roll is raised. This roll is then lowered, and an initial bend put in the front end of each blank by means of a vertically moving slide. Next by operating a friction clutch, the rolls are caused to revolve, with the result that the sheet is formed into a corrugated pipe, which can easily be removed after the upper roll has been raised. This machine can readily be adjusted to produce pipes of various diameters. The rolls make seventy-five revolutions per minute.

Compressing the Corrugations and Bending

In the third operation the corrugations of the pipe are compressed by means of the machine illustrated in Fig. 4, so that the pipe length is considerably shortened. A ring is inserted in each end of the work prior to placing it in the mold of the machine, the upper half of this mold being shown in a lifted position in the illustration. After the work has been inserted, the upper section of the mold is lowered and locked to the lower section. The pipe is compressed at one stroke of a ram which is controlled by a pin clutch, actuated by a foot-treadle. The rings placed in the ends of the pipe prior to the operation can be readily removed after the work is taken from the mold. This member may be adjusted to suit various sizes of elbows, by means of steel rings, inserts, and liners, and the amount of compression can also be varied. When the machine is operating continuously the ram makes fifty-one strokes per minute.

The fourth operation in the manufacture of the corrugated elbows consists of bending the pipe so that its ends form a right angle. The machine illustrated in Fig. 3 is employed for performing this operation, the work being firmly clamped on each end by means of a chuck. The relative positions of the chucks after the work has been placed in the machine is shown in the upper portion of Fig. 5. The operation of the machine

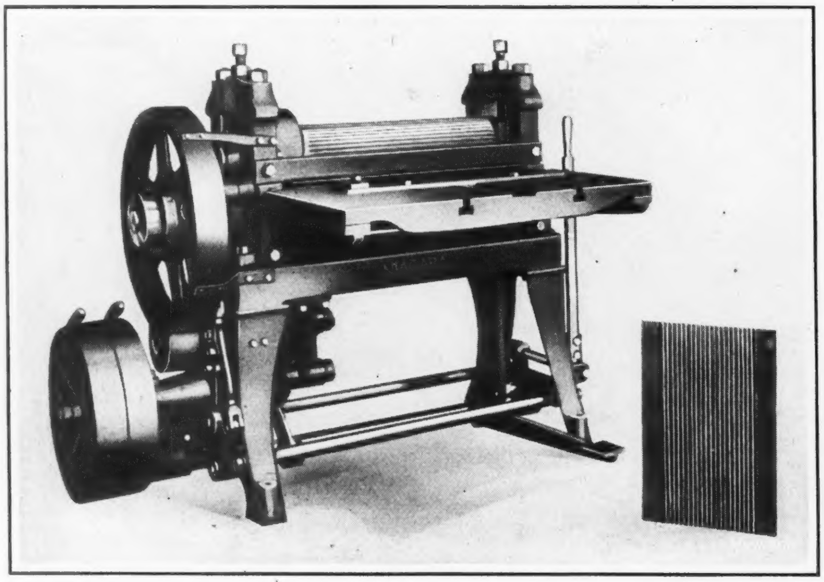


Fig. 1. Corrugating Machine on which the First Operation on the Blank is performed

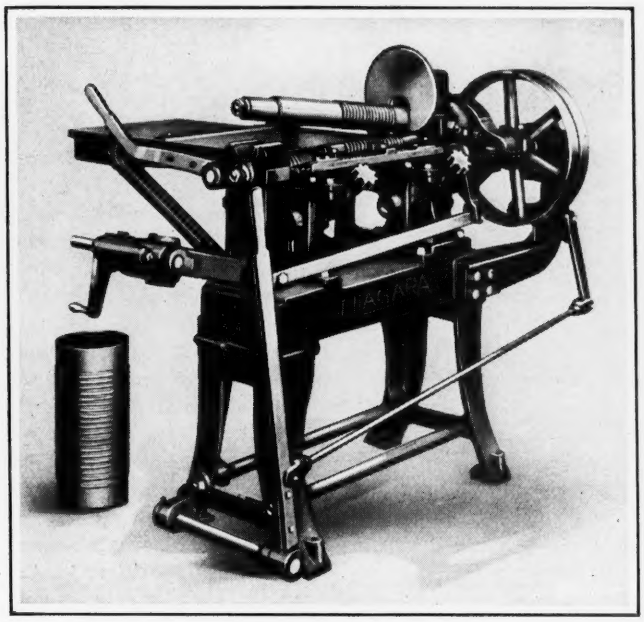


Fig. 2. Machine used to roll the Corrugated Sheet into the Form of a Pipe

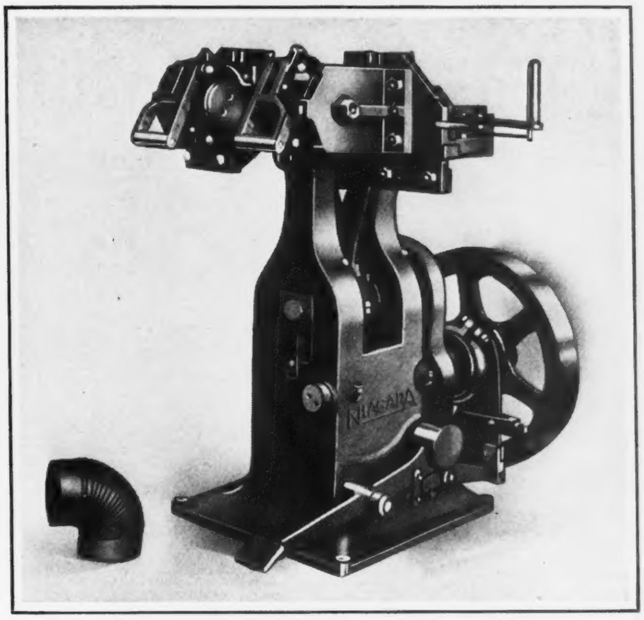


Fig. 3. Bending Machine with Chucks in Positions occupied prior to an Operation

causes these members to swivel to the position shown in the lower view, Fig. 5, in which they form a right angle to each other. The movement of the chucks separates the corrugations on the outer curve of the elbow and compresses them on the throat, thereby pressing the seams more firmly together, as the pipe is always so placed in the machine that the seam will come at the throat. In order that this machine may accommodate various sizes of elbows, it is provided with the essential adjustments and extra chucks and clamps. This operation completes the forming of the elbows. They are later spot-welded at each end, and then one end is crimped by means of a belt-driven machine having two crimping rollers between which the elbow end is passed. The bending machine may be operated at sixty-seven strokes per minute.

It is a known fact that the metal sheets supplied by the mills are not always uniform in gage, and so to compensate for any variations, the equipment described is designed to accommodate, without readjustment, sheets of more than ordinary variation. Metal sheets of No. 26 gage and lighter can be handled. The sheets also are not always uniform in quality, but it is said that sheets that could not be formed into elbows by other processes have been satisfactorily handled by means of the Niagara equipment. Usually a special quality of sheets is required for elbow manufacture, but with the machines described ordinary blue annealed sheets of good quality are suitable. The entire equipment may be driven by a 5-horsepower motor, and will produce elbows ranging from 4 to 8 inches in diameter.

* * *

SECTIONAL MEETINGS OF THE AMERICAN SOCIETY FOR STEEL TREATING

At a recent meeting of the board of directors of the American Society for Steel Treating it was decided to hold two sectional meetings of the society during the coming year, in addition to the regular annual convention. One meeting will be held in New York during January or February and the other in Pittsburg in May. The meetings will continue for one or two days and a few papers will be presented but no exhibits will be shown. The next annual convention and exposition will be held in Detroit on September 25 to 30.

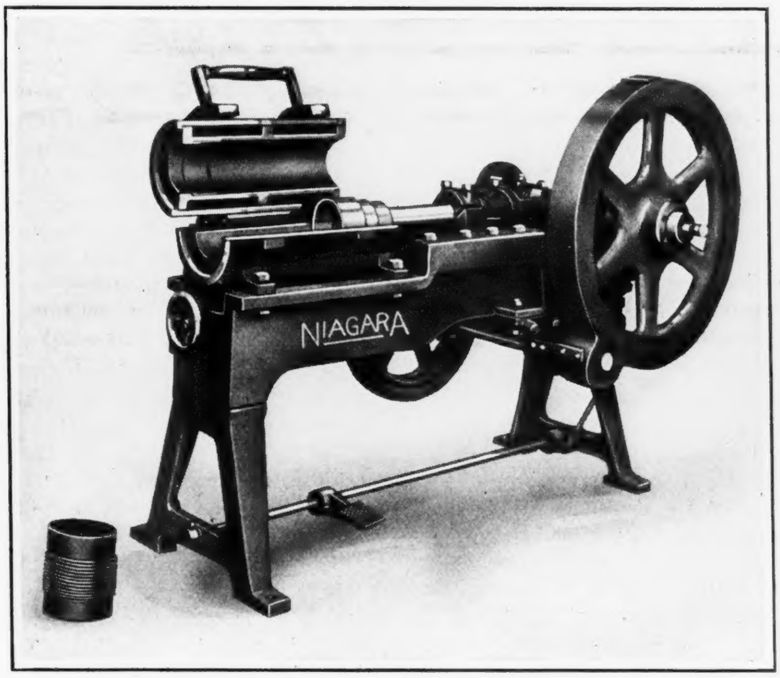


Fig. 4. Machine used for compressing Corrugated Pipe

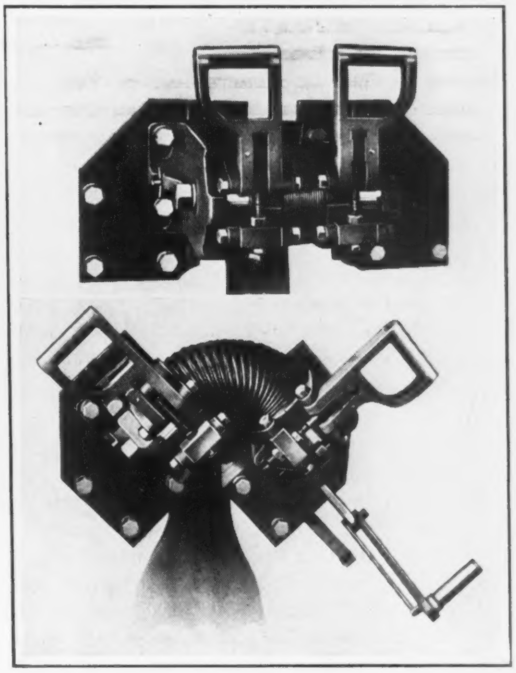


Fig. 5. Positions of Chucks before and after Bending

The Pratt & Whitney Automatic Lathe

Various types of hand-operated and automatic turret lathes and screw machines have been developed for rapidly turning short work from the bar or while holding it at one end only; however, the engine lathe is still used in innumerable cases of quantity production, when the work must be supported on centers during turning. These cases include work which, because of its length or peculiar requirements as to accuracy or finish, can only be satisfactorily turned on centers; work which is turned in preparation for a later grinding or machining operation, the engine lathe permitting the turning to be done on the same centers that are afterward used for other operations; forgings and other irregular pieces which, on account of their shape, cannot be readily held in chucking machines; and work in comparatively small quantities which does not warrant the cost involved in setting up a turret lathe or automatic screw machine.

With a view to eliminating a large part of the cost of turning work such as has been described, and at the same time retaining the advantages of the hand-operated engine lathe, the Pratt & Whitney Co., Hartford, Conn., has produced the automatic lathe shown in Fig. 1 equipped with a geared head. The rear view of a smaller machine driven by a four-step cone pulley is illustrated in Fig. 2. These lathes have a headstock, tailstock, magazine for holding the work, and an automatic work-handling and control mechanism. The automatic mechanism places the work on the centers, adjusts and clamps the tailstock spindle, grips the work by means of the rotating chuck, which serves only as a driver, starts the feed of the tool carriage, releases the tailstock and chuck at the end of the cut, and, finally, returns the carriage to the starting position. These steps are repeated automatically for each piece of work so long as the magazine is supplied with blanks. After setting up, the only attention required is that of refilling the magazine, taking away the finished parts, and grinding and setting the lathe tools. Because of this fact it is possible for a battery of machines to be handled by one man.

Although these lathes are only now being introduced to the trade they have been used in the Pratt & Whitney shops for years in turning high-grade tap and reamer blanks and other similar work, and have proved their ability to rapidly and cheaply turn cut-off bar stock, forgings and other parts with the accuracy and finish generally obtained in good engine lathe practice. The smaller machine takes work from ¼ to ⅝ inch in diameter and up to 12 inches in length, and has a carriage travel of 8 inches. The larger lathe takes work from ½ to 1⅛ inches in diameter and up to 15 inches in length, and has a carriage travel of 12 inches. Many forgings of irregular shape and with a swing larger than the diameters given can be handled to advantage.

As previously mentioned, the lathe has been developed with either a cone-head or a geared-head drive. On the cone-head machine a belt from a countershaft drives the headstock spindle and feed mechanism, while a separate belt from the countershaft drives the automatic mechanisms at a constant speed. On the geared-head machine, one belt from a lineshaft drives the entire machine, all speeds and feeds being obtained within the machine. The number and range of spindle speeds is greater with the geared-head machine, and the drive is more powerful. Speed changes are made by shifting the ball-handle lever *A*, Fig. 1, on the headstock, in an H-slot to any one of four positions, and also shifting the adjacent back-gear lever. This gives a total of eight speeds. On the larger machine four feeds are available for each spindle speed, and on the smaller machine, three feeds may be obtained for each spindle speed.

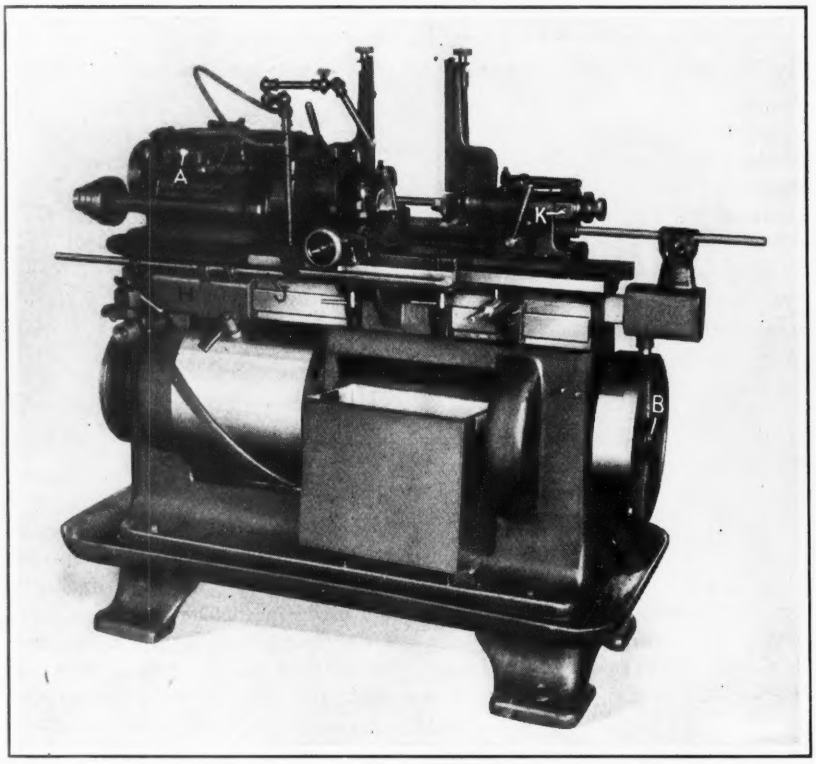


Fig. 1. Geared-head Automatic Lathe developed by the Pratt & Whitney Co.

The Camshaft Drive

The cams which operate the automatic mechanisms of the machine are mounted on shaft *B* running the entire length of the machine. This shaft is rotated at two different speeds. The slow rotation is adjustable and gives the advancing feed for the carriage, while during the rapid rotation, which is constant, the chuck is opened, the footstock spindle withdrawn, the carriage returned, the stock from the magazine advanced, the footstock spindle advanced and clamped, and the chuck closed. Power for the slow rotation is obtained through the small cone pulleys seen on the end of the machine in Fig. 2. The center distance between these cones is adjustable so that the proper belt tension may be maintained. The lower cone shaft transmits power through worms and worm-wheels, clutch *E*, and shaft *D* to camshaft *B*, as shown in the sectional view in Fig. 3.

Power for the rapid rotation of the camshaft is delivered to the small plain pulley *C*, Fig. 2, on the gear-box, a swinging idler being provided to maintain a sufficient belt tension to operate the mechanism. Power is transmitted from pulley *C* through spiral gears *F* to clutch *E*, Fig. 3, the drive from this point to the camshaft being through shaft *D* and a worm and worm-wheel used in the slow rotation. The toothed clutch serves to throw in alternately the feed and high-speed mechanism, at predetermined intervals, being

actuated through the medium of levers by adjustable trip-dogs *G*, Fig. 2, mounted on a disk at the left-hand end of the camshaft. The piping for the cutting coolant and the circulating pump, which is chain-driven at a constant speed, are also shown in the same illustration.

The hand-lever seen at the left-hand end of the machine in Fig. 4 gives a complete control of all machine movements except the rotation of the headstock spindle. Depressing this lever stops the rotation of the camshaft, and when it is raised and drawn forward, the camshaft rotates at high speed. When the lever is pressed toward the machine, the feed is thrown into engagement, and when elevated above the horizontal position, the feed will stop at the end of the cut to permit calipering or inspection of the work. The squared end of the shaft which is located below this control lever enables the machine to be operated by a hand-crank for trial when it is being set up.

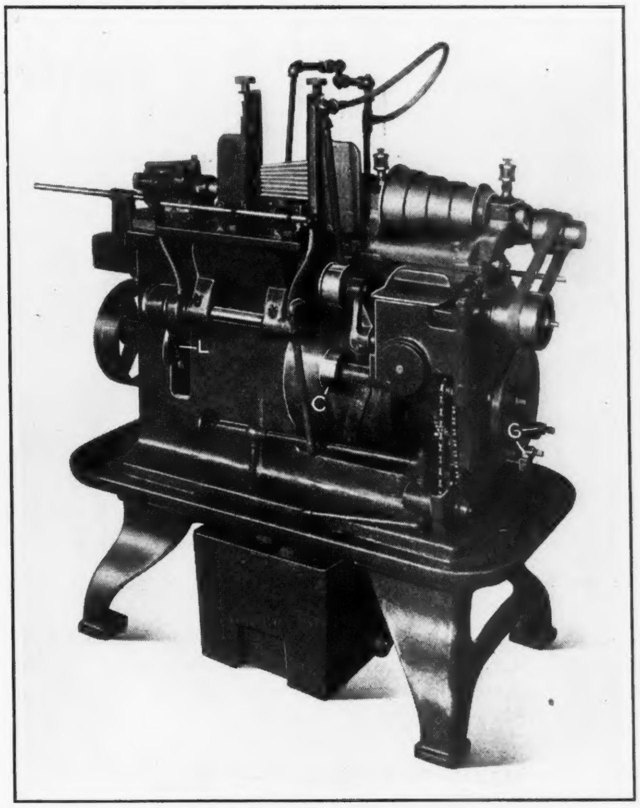


Fig. 2. Rear View of Cone-driven Automatic Lathe

The Carriage and Footstock

The carriage slides on the front of the bed and allows finished work to drop through an opening in the bed to the box below. The carriage has a cross-slide with adjustments on which may be mounted a toolpost and a follow-rest when needed. A jointed taper bar carried on a heavy bracket clamped to the front of the bed provides for turning taper work, and both straight and taper surfaces can be turned in one continuous cut. Various former bars may be substituted for the adjustable taper bar. The carriage is traversed the desired length of cut by the rotation of the large drum which carries cam straps, that, through a roller on slide *H*, Fig. 1, move the carriage-actuating rod *J*. Slide *H* is dovetailed to the bed. Provision is made for hand adjustment of the carriage by a rack and pinion which may be seen near the right-hand end of the machine in Fig. 1.

The spindle of the footstock is drawn back to release finished work and advanced to take new work by the operation of cams mounted on the pulley which may be seen at the extreme right-hand end of the camshaft. These cams, through a roller, move the slide mounted directly above it, and this slide, in turn, is coupled to a friction ring *K* on the footstock spindle. The rod connecting the slide and friction ring allows the footstock to be placed as far forward on the ways of the bed as the shortest work will require.

A slight slip of the friction ring takes place each time the spindle is drawn back, this being caused by the stop-collar on the front end of the spindle coming into contact with the front of the footstock casting. Therefore, when the spindle is advanced into contact with the work, the friction will again slip, insuring the proper contact with work in

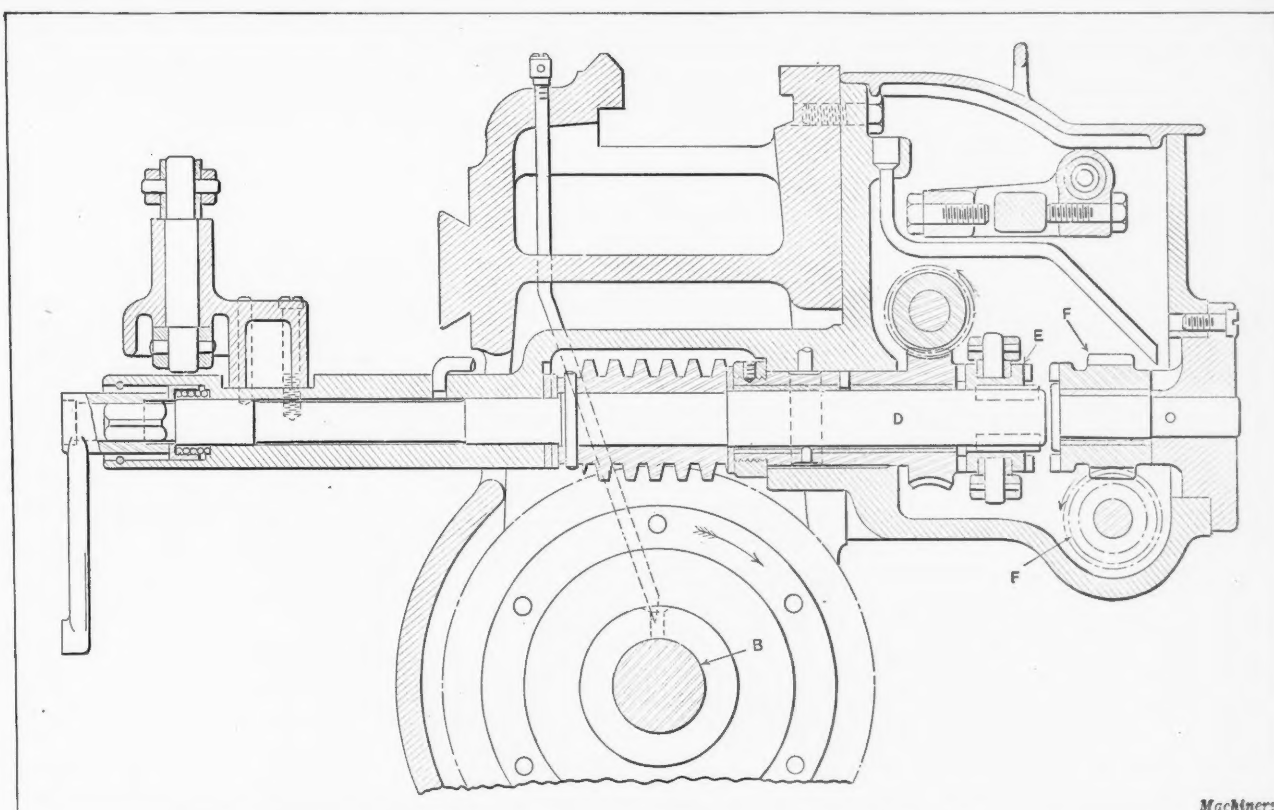


Fig. 3. Sectional View of Mechanism by Means of which Fast and Slow Rotation is imparted to the Camshaft

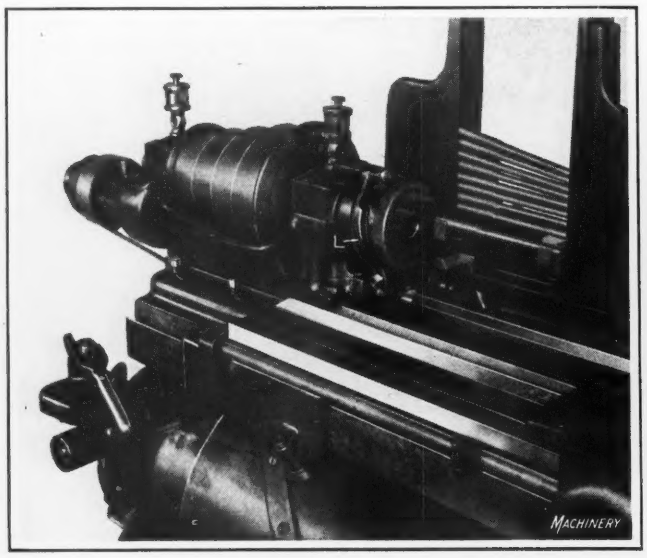


Fig. 4. Close-up View of Head End of Machine, showing Chuck and Work-feeding Mechanism

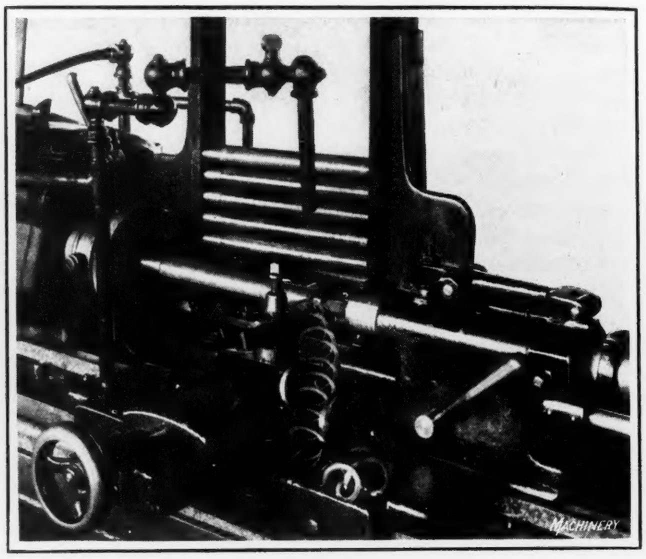


Fig. 5. Automatic Lathe engaged in taking a Heavy Cut on Work mounted on the Centers

spite of variations in length due to inaccuracies in cutting off and variations in depth of centering. The pressure with which the center is brought in contact with the work may be adjusted by the square-head screw on the friction ring. The footstock spindle is firmly clamped in place, after the center has made proper contact, by a further movement of the friction ring, which operates the horizontal lever over the footstock, thus forcing a plug on the spindle.

Construction of the Chuck

The chuck is mounted on the headstock spindle in such a manner that it floats laterally when necessary to compensate for inaccuracies in centering. Thus it can exert no lateral pressure on the work which is carried on the headstock center. Detail views of the chuck with the cover removed are shown in Fig. 6. At *A* the chuck is shown with the jaws drawn back ready to receive the work, which is inserted by the movement of the footstock spindle, as previously explained. The chuck jaws are moved into this position, while the lathe is running, by friction exerted on a drum carried by the chuck body. The friction is applied by the levers *L*, Fig. 4, and momentarily retards the rotation of the outer member of the chuck. This action not only draws the jaws back but also stretches the three springs shown in Fig. 6. Upon the release of the external friction, the springs move the outer member of the chuck in the forward direction, and thus swing the three jaws into contact with the work as shown at *B*.

An effective drive is obtained by the cam action of the jaws themselves without depending on the springs, and although the contact surface of the jaws is smooth so as not to mar the work, they will drive work under any cut which the lathe is capable of taking. The knurled surface on the outside of the chuck is used for setting it to the desired work diameter. Diameters between and including those indicated on the face of the chuck are taken care of by the rise of the cam surfaces on the jaws. Thus any size of stock within the capacity of the chuck may be driven if the knurled ring is revolved to the nearest indicated diameter on the chuck face. The alternate opening and closing of the chuck in proper sequence is controlled by a cam located on the camshaft directly beneath the headstock.

Operation of the Work Magazine

The position of the magazine, which is located on a bracket at the rear of the machine, is clearly shown in Fig. 4. The magazine consists of two uprights, adjustable to take both short and long work, and two guides on each upright adjustable to suit work of different diameters. Horizontal slides are provided for moving the pieces forward, one at a time, from the magazine to the machine centers. These slides are adjustable for all diameters within the capacity of the machine. As soon as a piece is brought into line with the centers, it is engaged at one end by the footstock center which pushes it endwise so that the other end enters the chuck and engages the headstock center. The tailstock is then clamped and the chuck closed on the work.

Yielding fingers are provided at the front of the transfer slides, so that when the work is securely mounted on the centers the slides withdraw before the lathe tool advances. In Fig. 4 the transfer slides are shown partially advanced with the work in place, the footstock and the carriage being removed so as not to obstruct the view. The transfer slides are operated simultaneously by levers shown at the rear of the machine in Fig. 2, which fulcrum on a horizontal shaft below the magazine. These levers, in turn, are actuated by the lever *L* which carries a roll engaging lugs on a cam. Leather friction washers are inserted between the cam lever and the adjacent vertical lever to allow slip in case work gets caught by being improperly inserted in the magazine.

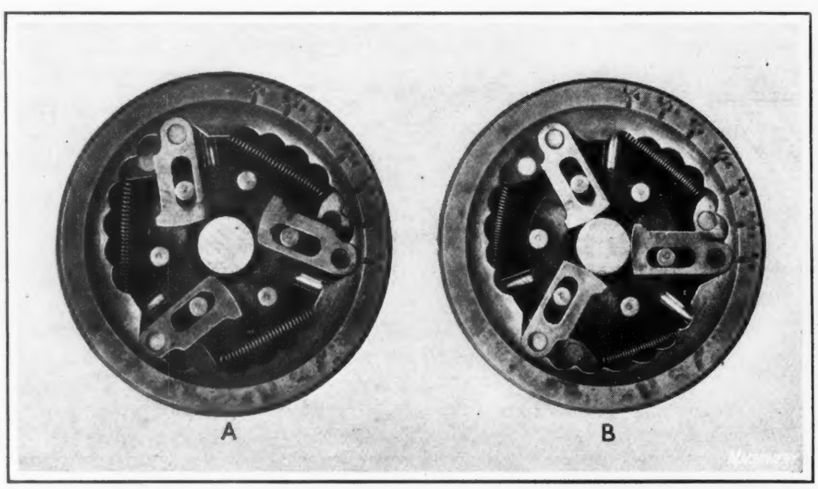
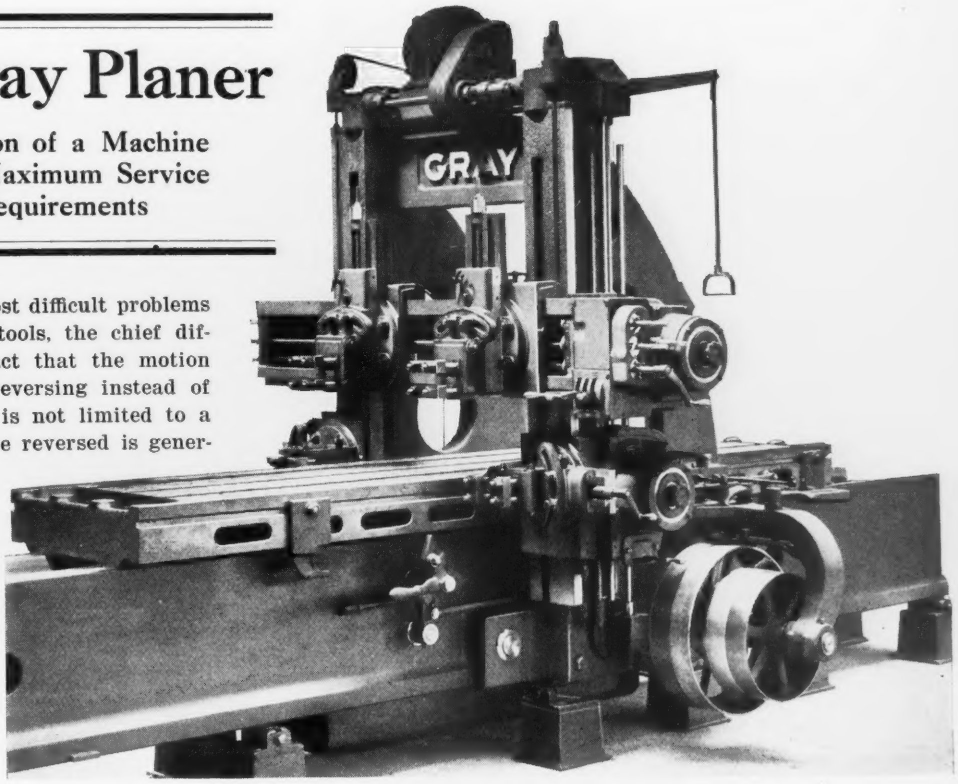


Fig. 6. Views of Chuck with Cover removed, showing Jaws in Open and Closed Positions

Care was taken in designing the machine to make it fool-proof, yielding elements being inserted in the mechanism where trouble from irregularities in the work may occur. The geared-head machine can be driven by a constant-speed motor mounted on the rear of the bed. Fig. 5 shows a close-up view of an operation in which a heavy cut is being taken.

The New Gray Planer

Features of Construction of a Machine Designed to Render Maximum Service Under Modern Requirements



PLANERS offer some of the most difficult problems to the designer of machine tools, the chief difficulties arising from the fact that the motion of a planer is intermittent and reversing instead of continuous; the length of stroke is not limited to a short distance; and the work to be reversed is generally heavy, so that the whole mechanism must be strong and durable. Another difficulty is due to the fact that a planer is a general-purpose machine, and while it must be rugged and powerful for the rapid removal of large quantities of metal, it must also be accurate for the generation of flat surfaces, and must produce a finish free from chatter marks.

The new line of planers built by the G. A. Gray Co., Cincinnati, Ohio, and termed by the builder "Maximum-service" planers, presents a good example of recent developments in planer design. Power, rigidity, durability, automatic lubrication, finish of the work, and convenience and safety of operation have all received due attention in the design of this line. A general view of the 36-inch machine is shown in the heading illustration.

Helical-geared Table Drive

The table is driven by a system of helical gearing which produces a smooth and powerful drive. A properly designed pair of helical gears is stronger than a pair of spur gears of the same pitch and width of face for the following reasons: In the case of a spur gear, the load at a certain point of a tooth engagement is concentrated along a line at the tip of the tooth, and the leverage is practically equal to the depth of the tooth. In the case of a helical tooth, the load comes on a line passing obliquely across the tooth face, and the leverage of the force amounts to only one-half the depth of tooth. Further, the helical gear tooth enters engagement gradually, eliminating shock. In addition to their greater strength, helical gears give a continuous pitch-line rolling action, since there is always some point on the pitch circle where mating teeth of the gears are in actual contact.

The helical gearing in the Gray planer table drive has a tooth form which is thicker at the root than teeth of the conventional form. This modification is said to increase the strength 40 per cent, eliminate interference, and reduce the angle of approach. It is while moving through part of the arc of approach that the so-called "stuttering" action takes place in gearing of the ordinary type. The angle of recess is purposely lengthened, however, because while a tooth is passing through the arc of recess the tooth friction tends to reduce instead of increase vibration. In the design of this gearing, use has not been made of stub teeth and large pressure angles, because while these features are of great advantage in certain kinds of work, the requirements of general planer service prohibit their successful use except for roughing and other service where gear chatter is not objectionable. The full-length tooth and low pressure angle of the special tooth form adopted in this gearing distribute the load among a greater number of teeth than would be the case with a larger pressure angle.

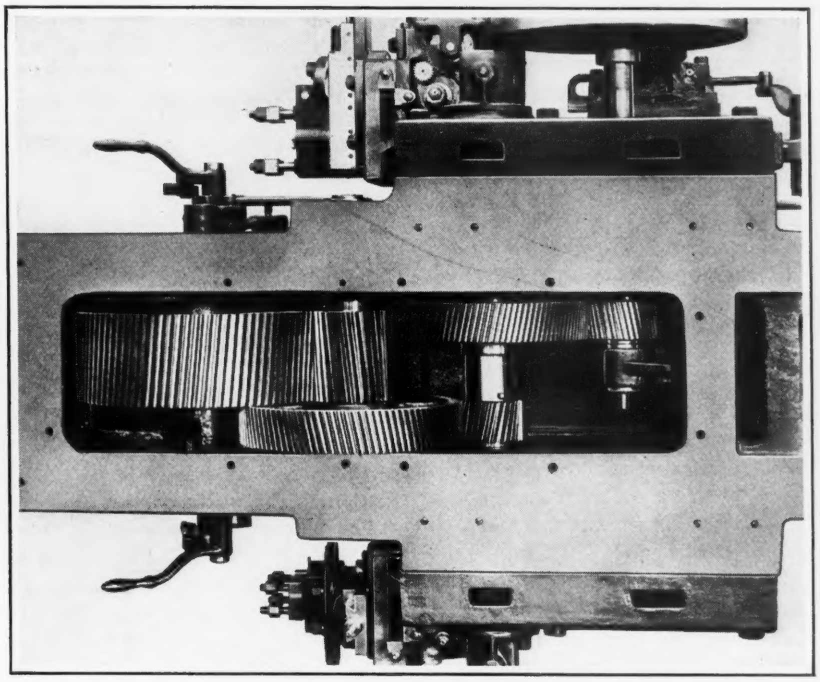


Fig. 1. Helical-geared Drive provided for the Planer Table

The gears dip into a reservoir of filtered oil so that the teeth are always covered with lubricant. This results in smooth action and long life of the gearing, because the oil film interposed between the teeth tends to cushion any shock that might be transmitted from one tooth to the other.

An objection to helical gearing sometimes raised is the fact that gears of this kind produce end thrusts. While such end thrusts may be eliminated by the use of herringbone gears, the Gray Co.

contends that a better system of gearing with wider faces, greater strength, smoother action, and longer life may be obtained if helical gears are used and advantage is taken of the end thrusts to counteract the tool pressure. A planer normally operates with the tools feeding from right to left, the operating side of a planer always being the right-hand side, and the side thrust of these tools tends to push the work and the table toward the left. The teeth of the bull gear in the planer design under discussion are so cut that the end thrust which the gear produces on the table is about one-tenth of the driving force, thus practically balancing the side thrust of ordinary cutting tools; because of this design the planer table bears equally on all four faces of the guiding ways.

The bull gear does not tend to move endwise since the end thrust of the bull pinion balances that of the table rack. The remaining gears of the train are so disposed that each one partially balances the end thrust of another, leaving only a small end thrust which is taken care of by bronze washers supplied with oil by forced lubrication. Most planer work does not occupy the entire width of the planer, and for convenience is placed close to the operating side of the machine. It is, of course, desirable that the line of action of the force which drives the table rack should coincide as nearly as possible with the line of action of the cutting tools. The rack of this planer is, therefore, widened toward the operating side of the machine which brings the line of action of the forces in an advantageous position.

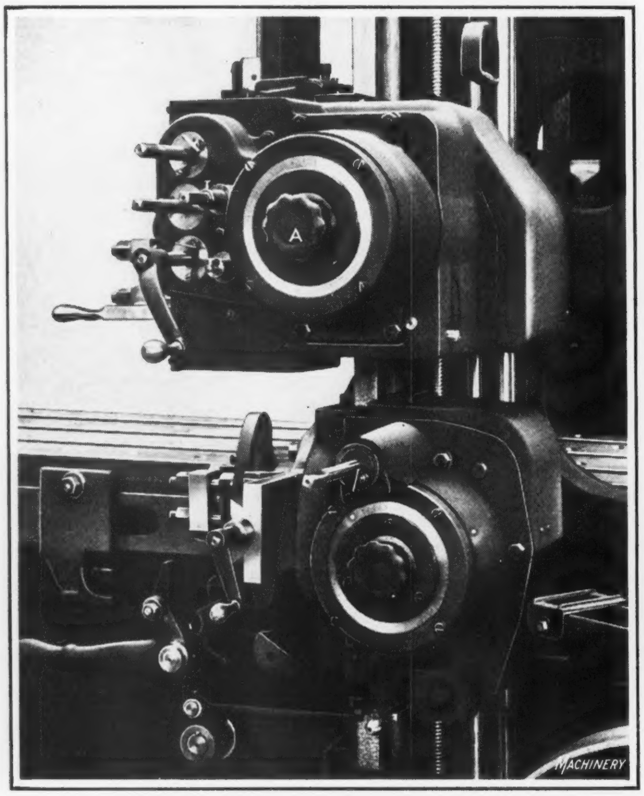


Fig. 2. Feeding Mechanisms for the Rail- and Side-heads

The "Cantslip" Feeding Mechanism

One of the greatest advances in lathe design was the development of the quick-change-gear system, and it is not too much to say that quick-change gearing has increased the production of the lathe from 20 to 30 per cent by making instantly available the feed best adapted for the work in hand. While the conventional friction-and-rack feed of the planer has undergone a great deal of refinement that has made it much more satisfactory and efficient than originally, many engineers consider the positive feeding and quick-changing devices employed in the lathe, boring mill, and milling machine to be still better. In designing the feeding mechanism, the Gray Co. had in mind the following points:

1. The mechanism must be positive and not subject to slip or wear.
2. The mechanism must be enclosed so that chips and dirt cannot affect it.
3. The side-head feeds must be independent of the rail feeds.
4. The amount of feed must be instantly adjustable while the planer is operating.
5. The adjusting mechanism must indicate exactly the amount of feed for which it is set.
6. The direction of feed of the rail-heads must be instantly changeable.
7. The adjusting mechanism must be in a convenient and accessible position.

The design developed to meet these requirements is illustrated in Fig. 2. One of the intermediate shafts in the main drive is extended through the housing, and by means of a flexible coupling, drives a pair of bevel gears running in oil. From these gears there rises a vertical splined shaft which rotates alternately in either direction as the planer operates. This motion is transmitted to a ratchet mechanism on the cross-rail, so designed that pawl lifters projecting from the aluminum case which completely encloses the mechanism, strike upon stop-pins, one of which is fixed, while the other is adjustable. When one of the lifters strikes the corresponding stop-pin, the ratchet mechanism is automatically disengaged and the aluminum case brought to rest, remaining so until the vertical shaft which drives the mechanism reverses its direction with the reversal of the planer. The ratchet mechanism operates noiselessly, and all parts are lubricated by oil contained in the case and supplied through oil passages in the driving shaft. On the periphery of the case is pressed a large ring gear which transmits its motion to the gears on the feed-screws and feed-rod.

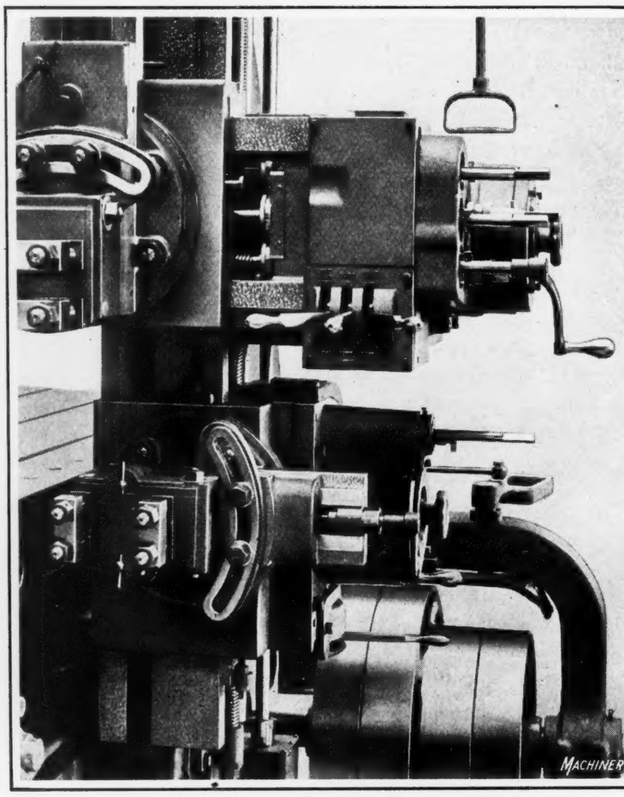


Fig. 3. Feeding and Power-traverse Mechanisms

The ratchet box is enclosed in a cylindrical case which forms a gear guard and serves to support the feed-adjusting device, consisting of a circular plate in which a hole is broached for a sliding bolt. The bolt engages teeth cut in a nickel steel ring and is withdrawn from engagement by slightly turning knob *A*. Any further turning of the knob revolves the plate and its attached stop-pin to the desired position. When the knob is released, the bolt re-engages the

teeth in the ring, and the plate and pin are locked firmly in place. Graduations on the disk indicate the amount of feed in thousandths of an inch. It will be seen from this description that only an instant is required to obtain any desired feed, which may be varied by multiples of 0.010 inch. The smallest feed obtainable is 0.010 inch and the largest 1.250 inches.

The side-head feed is independent of the rail-head feed, but is operated and adjusted in an identical manner. With this arrangement the side-head feed may be large while the rail-head feed is small, whereas with the conventional friction-and-rack feed, the side-head feed is necessarily equal to or less than the rail-head feed. The feed mechanism is provided with a safety device in the form of a small pin at the lower end of the vertical feed-shaft, which will shear without damaging the mechanism if the heads are fed together or any other accident results from carelessness or inattention on the part of the operator. The vertical shaft is hardened to receive the pin, and it is but the work of a moment to replace the latter.

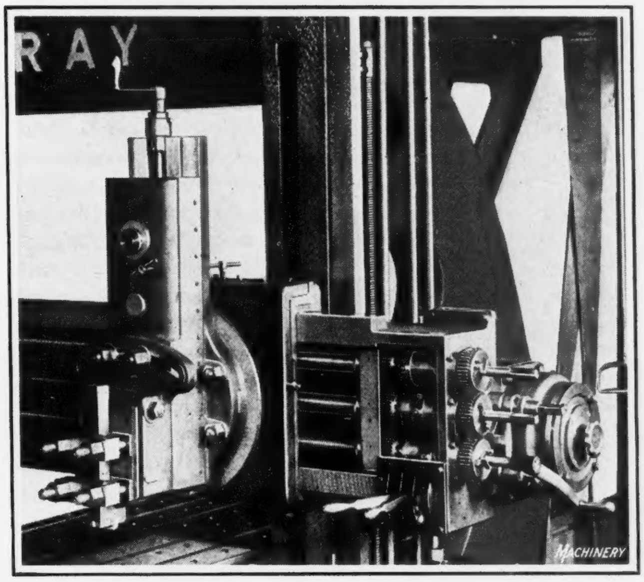


Fig. 4. Close-up View of Rapid Power-traverse Mechanism with Cover removed

Developing the Rapid-power Traverse

With the increased speed of cut permitted by the use of high-speed steel and the increased feed and depth of cut possible on modern machines, work is finished more rapidly and a larger proportion of the time is expended in changing tools and moving the heads from place to place. This calls for increased effort on the part of the workman, and a rapid-power traverse enables this work to be done without fatigue and in less than one-third of the time required if the heads must be traversed by hand. For a power traverse to be of value, it must be so simple and easy of manipulation that no appreciable time is required to put it in motion. It should not be necessary to do anything beyond moving a single member controlling the part to be traversed. Otherwise, so much time is taken in the manipulation of the mechanism that little saving results from the increased speed of head movement. Above all things, it is important that a workman should not be required to perform a series of steps before moving a head, if a serious accident to the machine may occur when one of these steps is neglected.

Accordingly, in designing the power traverse for the planer being described, the following points were borne in mind:

1. There must be only one handle for each movement required.
2. The movement of this handle must automatically perform all the functions necessary to disengage the feed, engage the power-traverse mechanism, and energize the source of power.
3. The direction in which this handle is moved must correspond to the direction in which the head controlled by it is moved.
4. It must be possible to move any head in either direction while the planer is in operation.
5. The moving of a head must not disturb the operation of any other head.
6. No part of the rapid power-traverse mechanism should run when it is not being used.
7. The mechanism must not revolve the handles or the handle shafts on account of the danger involved.
8. A power traverse must be provided for the side-heads, where it is sometimes even more important and desirable than it is for the rail-heads.

In addition to the requirements stated in the foregoing, which are vital to the operation of the machine, a number of other requirements had to be met relative to the manufacture and assembly of the mechanism. The device must be simple and compact, or it cannot be placed in the limited space available in the side-heads. A number of designs which filled the operation requirements were unsatisfactory because they did not lend themselves to the system of unit assembly which finds so large a place in modern machine tool practice.

Operation of the Rapid Power-traverse Mechanism

The design finally evolved is shown in the heading illustration and in Figs. 3 and 4. The mechanism is driven by an electric motor mounted on the top brace, which may be of either the alternating- or the direct-current type. The motor receives its current through a reversible controller. A gear-box, also mounted on the top brace, contains the necessary reduction gears which run in oil, and in addition serves to support the rail-elevating device. Power from the gear-box is transmitted to the power-traverse clutch mechanisms located at the end of the rail, and on the side-heads. The handles seen projecting from the power-traverse box at the end of the rail, and from the bottoms of the side-heads,

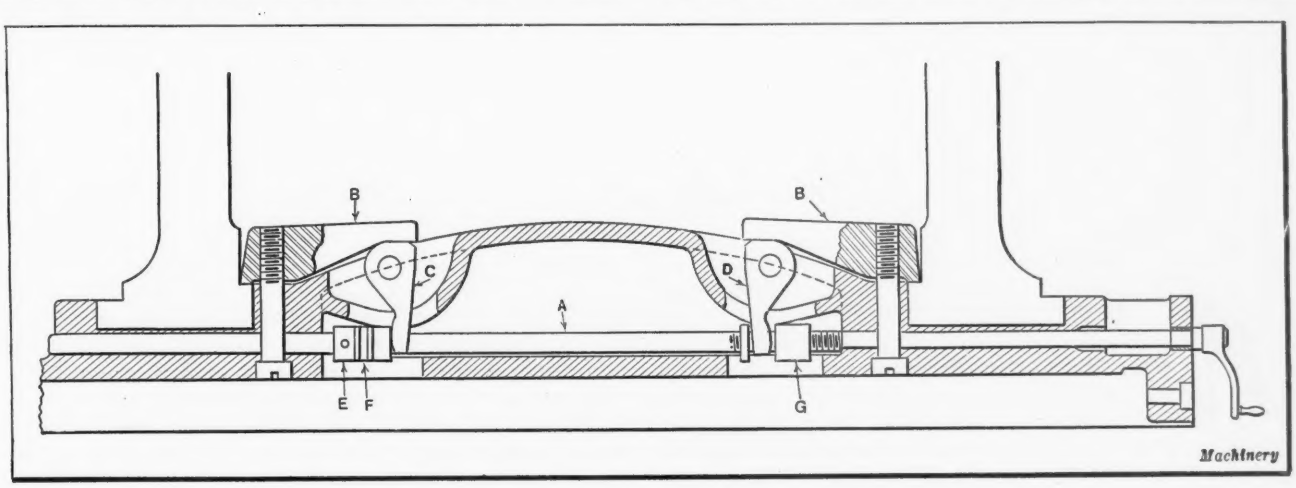


Fig. 5. Diagrammatic View of the Rail-locking Arrangement on the Gray Planer

are connected with rotary cylindrical cams which have an endwise motion and are concentric with the rail or side-head screws, as the case may be.

A movement of one of the handles rotates its cam and shifts it endwise, causing the unclutching of the corresponding screw from the feed mechanism and clutching it positively to the power-traverse gearing. The same movement causes the handle to engage and rotate a collar, the movement of which is transmitted to the controller. The direction in which the handles are moved determines the direction in which the controller rotates, and hence governs the direction of rotation of the motor and of the head movement. When one handle is moved from neutral to the operating position, all other handles are automatically prevented from moving so that the mechanism cannot be injured by carelessness on the part of the operator. The motor stands still except when the handles are moved. A lubricating system, which requires no attention except the filling of two reservoirs on the rail and one on each side-head every morning, carries oil to all parts of the power-traverse mechanism.

Rail Elevating and Clamping Devices

When the rail is clamped to the housings by means of a pair of cast-iron clamps bearing against ledges on the outside edge of the housing faces and drawn up by two bolts, in order to move the rail, it is necessary for the operator to take seven distinct steps as follows:

1. Loosen the two bolts on the right-hand clamp.
2. Walk around the planer.
3. Loosen the two bolts on the left-hand clamp.
4. Operate the lever controlling the elevating device while watching the height of the rail.
5. Clamp the two bolts on the left-hand clamp.
6. Walk around to the right-hand side.
7. Clamp the two bolts on the right-hand clamp.

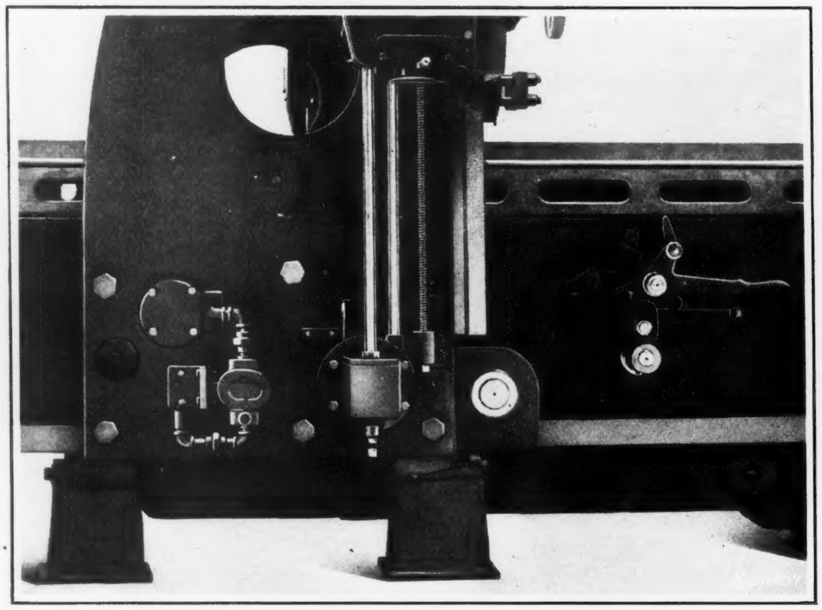


Fig. 6. View of Left-hand Side of Machine, showing Lubricating Pump and Filter

In contrast to the foregoing the new Gray planer has a rail-elevating and a rail-clamping device, the operation of which involves only three simple steps that can all be performed without requiring the operator to move from his normal position.

The rail is clamped by means of the device illustrated in Fig. 5 in which two steel clamps *B* are fastened to the rail by heavy screws. These clamps engage ledges on the inner edge of the housing faces and are capable of slight rotation due to play of the screws in the rail. Bellcrank levers *C* and *D* bear against the inner end of the clamps, and are secured to the rail by pins. A collar *E* is pinned on shaft *A*, and interposed between this collar and the projecting end of lever *C* is a ball thrust bearing *F*. The longer end of bellcrank lever *D* engages a nut *G* on shaft *A*. The latter is parallel with the rail screws and projects from the operator's end of the rail, where it has a squared end similar to the rail screws. When it is desired to unclamp the rail, it is only necessary to remove the crank handle from one of the rail screws, place it on the end of the rail lock-shaft and give this shaft three turns. This causes nut *G* and collar *E* to separate, which results in rotating levers *C* and *D* about their pins and moving clamps *B* away from their ledges. Turning the handle in the opposite direction with a moderate effort draws the longer ends of *C* and *D* together, and clamps the rail securely to the housing.

The two clamps *B* bear on the ledges with exactly equal force, since the same pull is exerted upon each of the levers *C* and *D*; this prevents slippage of one side of the rail and resulting inaccuracy of the work. Moreover, it is impossible with this device to neglect to clamp or unclamp one side of the rail. By clamping the rail at the inside, the length subject to torsion is reduced, and the increased power of the clamp makes it unnecessary to use four clamps to hold the rail.

The rail-elevating mechanism is operated by a lever placed on the right-hand side of the machine. From this lever, a stirrup is suspended by a universal joint, as can be clearly seen in the heading illustration. The lever is normally locked in position, but a quarter turn of the wrist unlocks it, permitting it to be pushed up or pulled down. Moving the lever, clutches the elevating shaft to the reduction gears previously referred to, and simultaneously starts the motor. The operator, when holding the stirrup, stands in front of the housings where he can plainly see both the rail and the work. If the operator wishes to raise or lower the rail, he has only to turn the rail-locking shaft three turns to the left, push up or pull down on the stirrup, and then turn the rail-locking shaft again three turns to the right.

Provision for Lubrication

The accuracy and durability of a machine tool depend greatly upon the system of lubrication provided. If an oil film is always maintained between bearing surfaces, the surfaces are subjected to less wear and the machine will maintain its accuracy longer. The Gray planer is provided with a system of forced lubrication, a Brown & Sharpe geared pump being bolted to the left-hand housing and driven from the pulley shaft by means of a flexible coupling. The pump takes its supply of oil from a large cast-iron reservoir bolted to the bottom of the bed, and discharges through a filter in the housing. The filtering material can be readily removed and replaced by taking off the hand-hole cover shown in Fig. 6. Piping leading from the filter passes to the various bearings so that they are abundantly supplied with filtered oil, the used oil draining back into the reservoir from which it is pumped.

The oil supply is maintained at the proper pressure by a combination pressure relief valve and an accumulator placed in the line. Piping from the filter also leads to two holes drilled into the vees of the bed at the center of its length. Each table vee has a large oil-channel from which the numerous supplementary oil-grooves carry oil to all parts of the bearing surfaces. These oil-channels run the length of each table vee, and are closed at the ends. By this means the oil pressure is maintained constant throughout the entire length of the table. This design has the advantage that the oil supply is equal at all points, no matter what the relative position of the table and the oil supply in the bed may be. If short stroke work is being done near one end of the table, for instance, the oil does not have to flow

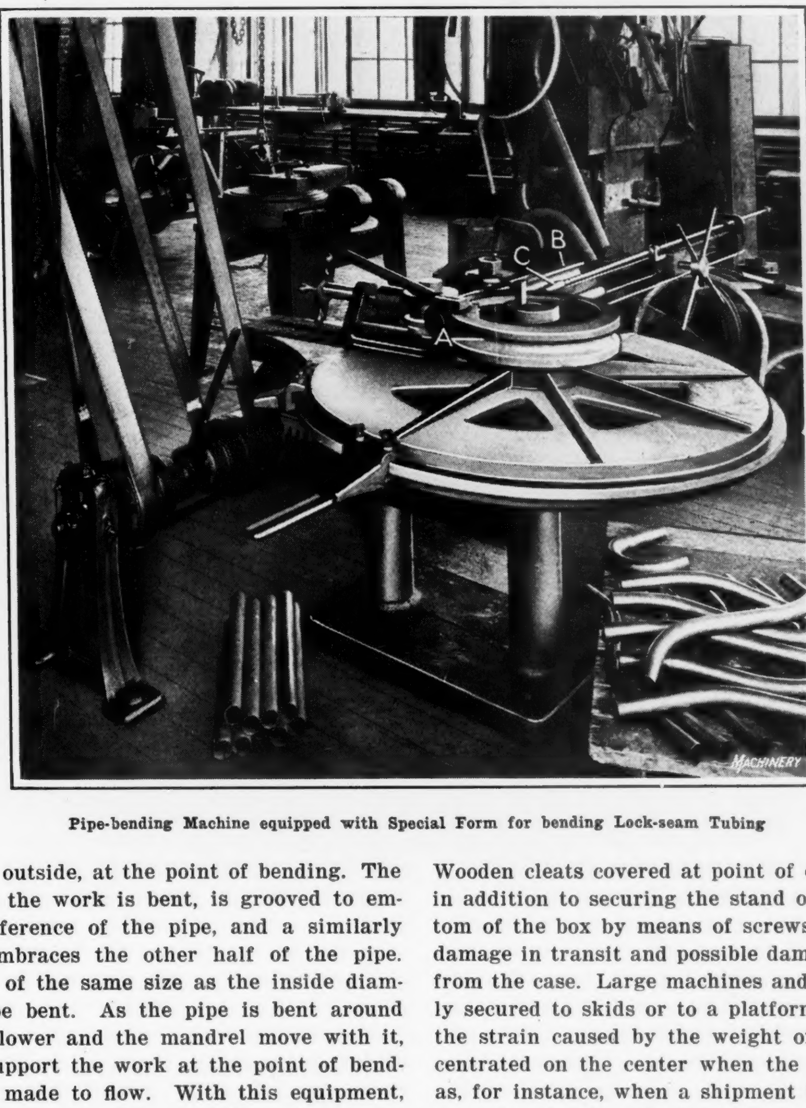
through a long groove of limited area to reach the far end of the table. The surplus oil dripping from the vees and table rack flows through a heavy screen into a settling basin at each end of the bed and returns to the central reservoir through piping contained in the bed. In order to support the table when it is in its extreme position and to prevent the dripping of oil from the vees to the floor, the bed is made twice the length of the table. This prevents the table from springing, as there is no overhanging weight, and thus prevents the end of the bed from cutting the under side of the table. It also makes unnecessary special projections for catching the dripping oil, and constitutes a safety feature, since the table never extends beyond the bed.

* * *

BENDING LOCK-SEAM TUBING

The Lock Joint Tube Co., of Mishawaka, Ind., manufactures what is known as "lock-seam" tubing, which is made with a folded seam. This concern realized that there was a market for its product in making automotive exhaust manifolds, but the tubing could not be bent to the forms required for this purpose without opening the seams. It might have been possible to make the necessary bends by first filling the tubing with melted lead or rosin, but that method would be too expensive for commercial production.

This problem was submitted to the Wallace Supplies Mfg. Co., of Chicago, Ill., and a special form was made for the purpose for use on this company's No. 5B pipe-bending machine. This equipment is so designed that the work is continually supported around the complete circle, both inside and outside, at the point of bending. The form *A* around which the work is bent, is grooved to embrace half the circumference of the pipe, and a similarly grooved follower *B* embraces the other half of the pipe. There is a mandrel *C* of the same size as the inside diameter of the work to be bent. As the pipe is bent around the form, both the follower and the mandrel move with it, so that they always support the work at the point of bending, and the metal is made to flow. With this equipment, it was found possible to bend lock-seam tubing without any tendency for the folded seam to open, and many new applications for this product were developed.



Pipe-bending Machine equipped with Special Form for bending Lock-seam Tubing

* * *

The Bureau of Standards, Washington, D. C., has published a booklet known as Technologic Paper No. 198, by A. H. Stang and L. R. Strickenberg, containing information on the strength and properties of rope of different kinds. This publication contains formulas and rules for determining the strength of rope made in different ways, and other information that would be of value to the user of rope for handling loads with proper safety.

SAFE PACKING FOR MACHINERY

The railroads, steamship lines, express companies, and Post Office Department have combined in a movement to awaken nation-wide interest in careful and secure packing of shipments. The aim of the "Perfect Package Campaign" is to bring American shipping methods to such a high standard that the great economic losses due in part to careless packing by shippers will soon be a negligible factor in the transportation industry. The transportation lines in the past have suffered losses in excess of $150,000,000 a year, due to poor packing, and this loss amounted to a great deal more during and immediately after the war. The carriers do not wish to dictate to shippers just how they shall pack their commodities, but they feel that their experience enables them to make suggestions that should be of value. Generally speaking, shipments should be so prepared or packed as to insure safe transportation with ordinary care on the part of the carrier. A recent study by transportation men of the packing methods of machinery has developed the suggestions given in the following:

The proper preparation of machinery and machine parts for shipment should, as a rule, be assigned to an experienced mechanic, except when standard packages are used. When articles are small, such as portable typewriters or small talking machines, and properly braced in their own case, corrugated and fiber board are satisfactory as outside containers, if of standard construction. When packed in wooden boxes or crates, all fragile parts should be protected from direct contact with cleats, etc., and all loose parts secured to prevent shifting and possible damage. Wooden cleats covered at point of contact with pads of felt, in addition to securing the stand of the machine to the bottom of the box by means of screws, offer protection against damage in transit and possible damage in removing the part from the case. Large machines and their parts are frequently secured to skids or to a platform that will not withstand the strain caused by the weight of the machine being concentrated on the center when the ends only are supported, as, for instance, when a shipment is being transferred from a car to a truck. The bearings or cast-iron frames are often left uncovered so as to prevent injury from hard knocks incident to handling unwieldy objects of this kind in the limited time allowed at small stations.

* * *

Drop-forged automobile wheels have recently been developed. At present they are used mainly on lower-priced cars. As compared with wooden wheels, the forged wheel has the advantage that it consists of a single piece, and even the brake-drum can be made in one piece with the wheel. It is practically unbreakable, and all trouble due to the shrinkage of wood is eliminated.

POINTS TO BE OBSERVED IN MACHINE TAPPING

By H. H. ARMSTRONG

It is the purpose of this article to call attention to the general need for more careful supervision of machine drilling and tapping operations, and to give suggestions concerning satisfactory methods of handling this class of work. As the operators of drilling and tapping machines used for quantity production work are usually paid on a piece-work basis, it naturally follows that various expedients are employed to obtain high production rates. If every piece is required to pass a thorough inspection, no fault can be found with any method that gives the desired result, but unfortunately the work in many cases is not properly inspected when it comes from the tapping machine. In an endeavor to obtain high productive rates, a considerable amount of inferior work is often put through which may, or may not, be thrown out when it arrives at the assembling department. If inferior work is passed by this department, it will in all probability cause the purchaser annoyance and give an unfavorable impression of the company's product.

Cause of Poor Threads

The question of drilling and tapping castings is therefore an important one, particularly when the material to be tapped is cast iron. In order to show some of the causes of inferior work, let it be assumed that a load of clean rough castings has been delivered to the machine shop, bearing a red ticket with the word "Rush" printed across it in heavy type. The foreman directs the load to an operator, who obtains the blueprint called for and immediately sets up his machine for the job. Before beginning work the operator usually ascertains the piece rate, and then decides whether the price is high or low. If the price seems too low, he knows that he will have to speed up his work in order to obtain a fair day's wage. He also knows that taps will be broken off in the work if the tapping machine is run too fast when tapping holes drilled with a regular size tap drill. The result is that a larger size of drill is often used, and this, in turn, results in a thread of shallow depth.

Generally the first piece tapped after setting up the machine is submitted for inspection, and if this piece is approved the whole lot may be passed, but if each piece were to be properly inspected with a limit plug gage it is more than likely that a number of pieces would be thrown out, because the gage would fit too loosely in the tapped hole. The castings then go to the assembly floor where the piece-work system is also employed. The assembler puts in the screws, and if in tightening them down he finds that some of them do not set or hold, he knows that the thread is stripped and he will either put the defective piece to one side or attempt to fix it by some makeshift method.

Tap Drill Sizes

It may seem strange that over-size drills are used in jigs which are supposed to be equipped with bushings of the proper size. Nevertheless it is a fact that bushings become worn under continual use, so that they will easily admit a larger size drill than that for which they are intended. The writer knows of some cases in which shop foremen have requested the tool department to enlarge the bushings of a new or changed drill jig slightly, claiming that the taps were over-size and were being broken too frequently. This is often due to the fact that the tapping machine is run at too high a speed, and if it is slowed down the trouble would be eliminated. The tool department should not comply with requests to enlarge the hole in a drill bushing, and no bushing should be changed from the dimensions called for by standard clearance tables unless the change is approved by the designing engineer.

In observing tapping machines in operation, it will be noticed that the spindle reverses its direction of rotation in backing out of the tapped hole, and that sometimes the tap is brought down again while the spindle is running in the reverse direction. This causes the threads of the tap to tear the metal at the mouth of the hole to a depth of perhaps 1/8 inch or more. On noting this, the operator will invariably pull up the tapping head, and by the time he finally gets the tap running in the right direction some of the thread will have been torn out, so that the screw will only hold in the section of the thread below the stripped portion. If, in addition to the stripping of the threads, the tap drill happens to be too large, the thread will be practically useless. The tap drills used in tapping machines are always larger than the ones used when tapping a full thread by hand, so that if the operators use still larger tap drills in order to speed up the machine tapping, it is sure to result in the stripping of threads in the assembling department.

Trouble from Sharpening Taps and Clogging of Chips—Need for Thorough Inspection

Another source of trouble may be mentioned here, namely, that resulting from the sharpening of the end of the tap by the operator. This is done by grinding a new taper on the tap, and while this may prove satisfactory for tapping operations on thin work, such practice should not be followed when tapping work in which the tap cannot pass entirely through, as the bottom of the hole will not have full threads. For the latter type of work, bottoming taps should, of course, be used, which permit cutting practically a full thread to the bottom of the hole. Recently the writer's attention was called to some work in which the assembler could not enter the screws to the required depth. On examining the pieces it was found that the tapped holes were filled with the chips from the tap that had lodged in the thread and become firmly attached by a coating of rust. These pieces had to be sent back to the machine shop to be retapped. In this case the operator was required to do the work on his own time. Had he used compressed air to blow the chips out, this trouble would not have been encountered.

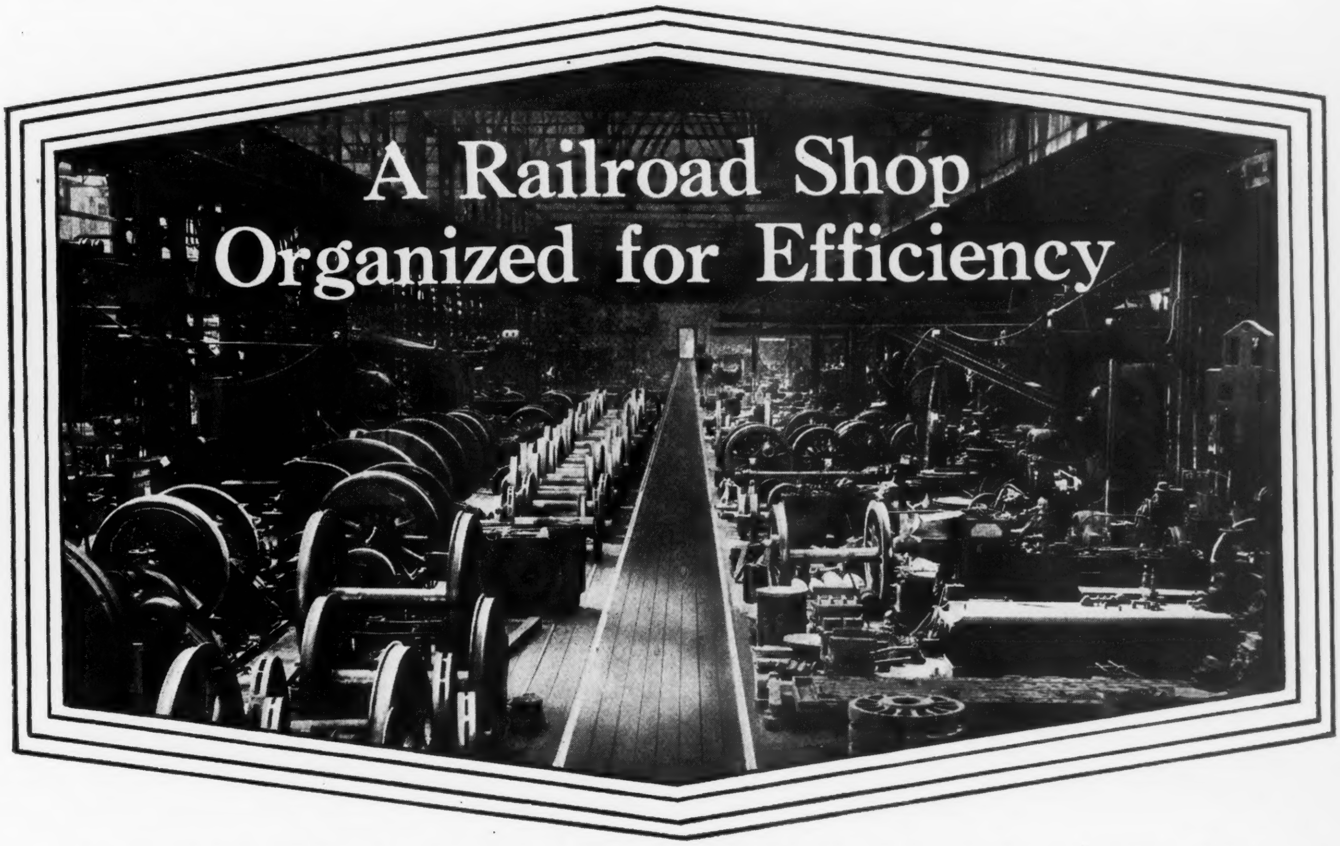
If a steel screw is set down too tight in a cast-iron piece, the threads are likely to become crossed and stripped, especially if the thread in the iron piece is shallow. Success in tapping holes depends chiefly on having conscientious operators who are willing to follow instructions and set their machines up properly for each job. If trouble is encountered, it should be brought to the attention of the foreman, and not covered up to be discovered at some later period. All machine tapped holes requiring any considerable degree of accuracy should be given a thorough inspection with a limit plug gage. The operator can do this if there is no inspector, and the foreman should keep in touch with the work. It has been proved by experience that the quality of a man's work will invariably be higher if he knows that the work is to be inspected. When excessive tap breakage is experienced, it is well to investigate the cause; in many cases it will be found that breakage is due to inefficient holding methods, the work being allowed to move during the tapping operation.

* * *

BRITISH MACHINE TOOL TRADE

Statistics covering the import and export trade of machine tools to and from Great Britain during the first six months of 1921 show that the imports amounted to 2243 tons, as compared with 2040 tons in the same period in 1913. The value of the imports in 1921 was approximately $2,000,000, as compared with $725,000 in 1913. The exports also show a great increase in 1921 over the corresponding period in 1913. The exports amounted to 12,977 tons in the first six months of 1921, as compared with 8545 tons during the same period in 1913, and the value increased from approximately $2,500,000 in 1913 to $7,400,000 in 1921. The exports of machine tools from Great Britain in the first six months of 1921 are the highest on record for that country for any similar period.

A Railroad Shop Organized for Efficiency



A Description of the Angus Shops of the Canadian Pacific Railway Co., Montreal, Canada
First of Two Articles

EFFICIENCY in railroad operation is a matter of great importance, not merely to the stockholders of the railway companies, but also, and in an even greater measure, to all classes of business enterprises served by the railroads. Efficient freight and passenger service rendered at reasonable cost is one of the essential conditions upon which the return of business prosperity depends. There are many phases of railroad management. The one in which the readers of MACHINERY are most directly interested relates to the handling of railroad shop work. In dealing with this subject, it is important to emphasize the two general causes of inefficiency in railroad machine shops. These are, first, the inefficiency of railway shop labor, and, second, the use of equipment, in many railroad shops, which is of obsolete design, inadequate capacity, and in poor condition. To re-equip a railroad shop requires a large investment, but in the case of many shops it would be an expenditure from which the railroad would derive an adequate return in the reduction of the cost of handling the shop work.

Returning to the question of the inefficiency of labor, American railroad shops have failed to turn out work at a reasonable cost, largely because of the provisions of the National Agreement on Working Conditions, which was entered into between the United States Railroad Administration and the railway shop workers during the period of government control. After an extended hearing of both railway executives and labor leaders, the United States Railroad Labor Board decided to abrogate the provisions of this agreement; but the labor unions are now making demands upon the individual railways for agreements specifying exactly the same undesirable conditions governing the work of shop employes, and pending the settlement of these controversies, the objectionable terms of the National Agreement remain in effect.

The Need of Better Equipment

With the return of labor to a normal state of efficiency, the railroad shop problem would be about half solved. Then the final solution would lie in the provision of more adequate machine tools and other equipment. Some of our railway shops are fairly well provided with machinery, but there are many in which the equipment is composed largely of obsolete machines incapable of producing results that could be obtained with modern machines. In addition, many machines are in such a poor state of repair that they are unable to give satisfactory results, as regards either the rate of output or quality of workmanship, and their use makes the cost of the work very high.

The experience in railroad earnings during the latter part of 1921 indicates that the railroads are about to enter upon a period of better financial conditions. Railroad managements generally look forward to brighter days provided labor troubles do not seriously disturb present favorable tendencies. As far as the problem of shop work is concerned, however, a state of "normalcy" cannot be expected until the standards both of labor efficiency and of shop equipment have been greatly improved.

It is safe to say that in the majority of American railroad machine shops, it will be necessary to increase the efficiency of both the men and the machinery in order to obtain pre-war results. New shop rules must be established that will make it possible to get work done in a way that will insure normal costs. Equally important is the question of machinery. Much of the machine tool equipment in some of the railroad shops is of obsolete design and in such a poor state of repair that the money lost by its continued use would pay a fair rate of interest upon the investment required to provide new machines. There are a few modern railroad shops, however, and the present article describes the layout and methods of operating one of them—the Angus shops of the Canadian Pacific Railway Co., Montreal.

How One Road Solved its Shop Problem

It is believed by many that the work in a railroad shop does not lend itself to being handled on a quantity production basis. Jobbing shop work is always costly, and unless a determined effort is made to break away from such a method of railroad shop management and to apply modern manufacturing methods of setting up work in multiple, it is futile to expect efficient results. In discussing this question of shop efficiency, it will be of value to explain the results that have been obtained by the Canadian Pacific Railway Co. at its Angus shops in Montreal.

This railway formerly maintained what were known as the Delorimier shops located near the center of the city of Montreal. Gradually this plant became inadequate for existing requirements, and the high value of the real estate on which it was built placed a heavy overhead charge on all of the work. As a result, it was decided to construct an entirely new plant, and for that purpose the site of the Angus shops was purchased on the northeast side of the city. This plant is noteworthy as a railroad shop on account of the fact that it was completely planned on paper before any construction work was started. Henry L. Gantt was retained as consulting industrial engineer to make a complete study of the problem, working in cooperation with H. H. Vaughan, who was then assistant to the vice-president and in charge of the Canadian Pacific Railway Co.'s motive power and rolling stock. The final result assures the inter-relationship of departments and an arrangement of equipment in each individual department which will permit the work to be performed with a maximum degree of efficiency.

Fort Williams represents the point at which the Canadian Pacific Railway lines are subdivided into the eastern and the western systems, and on each of these systems there are four divisions so that the entire road is subdivided into eight districts, each of which is served by a local shop where minor repairs and some general work are handled. The facilities of these district shops are supplemented by the Angus plant at Montreal, which serves the entire Canadian-Pacific Railway system. On the eastern lines, the heaviest work is sent to Montreal; and the Angus shops also manufacture many small parts in quantities and ship them to store-rooms of the different districts, where they are available when necessary. In this way, advantage can be taken of the increased efficiency resulting from handling the work on a quantity production basis, instead of setting up single pieces on machines which have sufficient capacity to handle a number of parts at a time, thereby placing a greater machine time charge against each individual job.

Classes of Work Handled at the Angus Shops

Under normal conditions of operation, the Angus shops provide employment for as many as 9500 men. With this force the plant is operated for the double purpose of making repairs on engines and cars, and building both these classes of equipment. The capacity under full operation is about as follows:

Engines, Pacific or Mikado type	4 per month
Engine repairs (complete overhauling)	40 per month*
Steel frame, single-sheathed freight box cars	15 per day
Steel frame automobile cars	10 per day
Refrigerator cars	9 per day
Steel sleeping cars	1 per day
Compartment sleeping cars	1 every two days
Car repairs (complete overhauling)	100 per summer month†
Car repairs (complete overhauling)	230 per winter month

*This represents average operation; from 45 to 70 engine repairs per month have been made when no locomotive building work was being put through the shops at the same time.

†The average capacity on car repair work is 230 per month, but in summer the heavy passenger travel makes it impossible to withdraw the necessary number of cars from the system and the repair work is so arranged that the majority of the cars are placed in the shop during the winter months.

Lay-out of the Angus Shops

The accompanying diagram shows a general plan of the lay-out of the Angus shops. As this plant was constructed with the idea of increasing efficiency by handling work on a quantity production basis, careful provision was made for the routing of all work so that no time and labor need be spent in the unnecessary moving of heavy engines or cars and the parts of such equipment. The general scheme of the plant lay-out is to bring locomotives and cars in from the main tracks which run along the southwest end of the property, and to carry them over tracks leading to the various departments.

In examining the lay-out of the plant with especial reference to the elimination of lost motion in handling the work, it must be borne in mind that the locomotive shop, the passenger car shop, the freight car shop, and the steel car shop are distinct units, so that no provision need be made for the transfer of work from one of these departments to another. On the other hand, it is necessary for each of these divisions to be served from the general stores, the blacksmith shop, the gray iron foundry, etc., and with that idea in mind it will be noticed that the buildings in which these three departments are grouped, are centrally located so that deliveries may be conveniently made to each of the main departments of the plant.

Arrangement of Equipment in Individual Departments

In order to see the way in which individual departments have been laid out to facilitate handling the work, let us consider first the freight car shop. Here it will be noticed that the wheel foundry is located in line with and southwest of the truck shop. The wheel castings made in this department are bored and turned and pressed on their axles, so that they may be easily rolled on tracks leading into the truck shop. Here the wheels and axles are assembled on the trucks which, in turn, are rolled out of the northeast end of the shop where they can be picked up by a midway crane and carried over opposite the end of the freight car shop. Here they are again dropped on tracks running through this shop. The building of freight car bodies is handled by a method similar to the progressive assembly used in some of the most progressive manufacturing plants.

It has been mentioned that as the trucks come out of the shop in which they were assembled, a midway crane carries them to tracks running longitudinally through the freight car shop. To the right of this crane, is the planing mill in which all timbers for the box cars are cut ready for assembly. This material is simply carried across by the midway crane to the freight car shop and there it is ready for use, the various parts being distributed along the shop so that as the cars are moved down the tracks, the different parts such as sills, flooring, walls, and roofing can be secured in place.

Arrangement for Handling Passenger Car Work

Passenger cars used on the Canadian Pacific Railway have either steel wheels or cast-steel wheel centers with steel tires. These wheels are purchased outside the plant, and in the passenger car shops there are truck departments where this material is assembled and prepared for the passenger cars. It will be noticed that the planing mill is so located that heavy timbers can be handled with almost equal facility for use on either passenger or freight cars. There is a difference of procedure in handling passenger car work, however, as a large part of the material used in such cars is hard wood, which must be kiln-dried and then placed in storage ready for delivery to the cabinet shop as required. A kiln is provided in connection with the hard wood storage which is located at the northeast corner of the plant; and this storage building is located adjacent to the cabinet shop, where the finer interior finish of various types of passenger cars is completed ready for assembly.

From this department, finished sections of the interior finish are drawn and taken direct to the cars in which they are to be assembled. Unlike the freight car work, the passenger cars remain stationary in the shop until they have been completed. Each car is mounted on tracks running crosswise in the shop, and upon completion it is pushed out to what is known as a transfer table which runs along the space between the two passenger car shops. A car placed on this transfer table is run down into alignment with a track at one end, from which it is moved out to the sidings and thence to the point of destination on the railway.

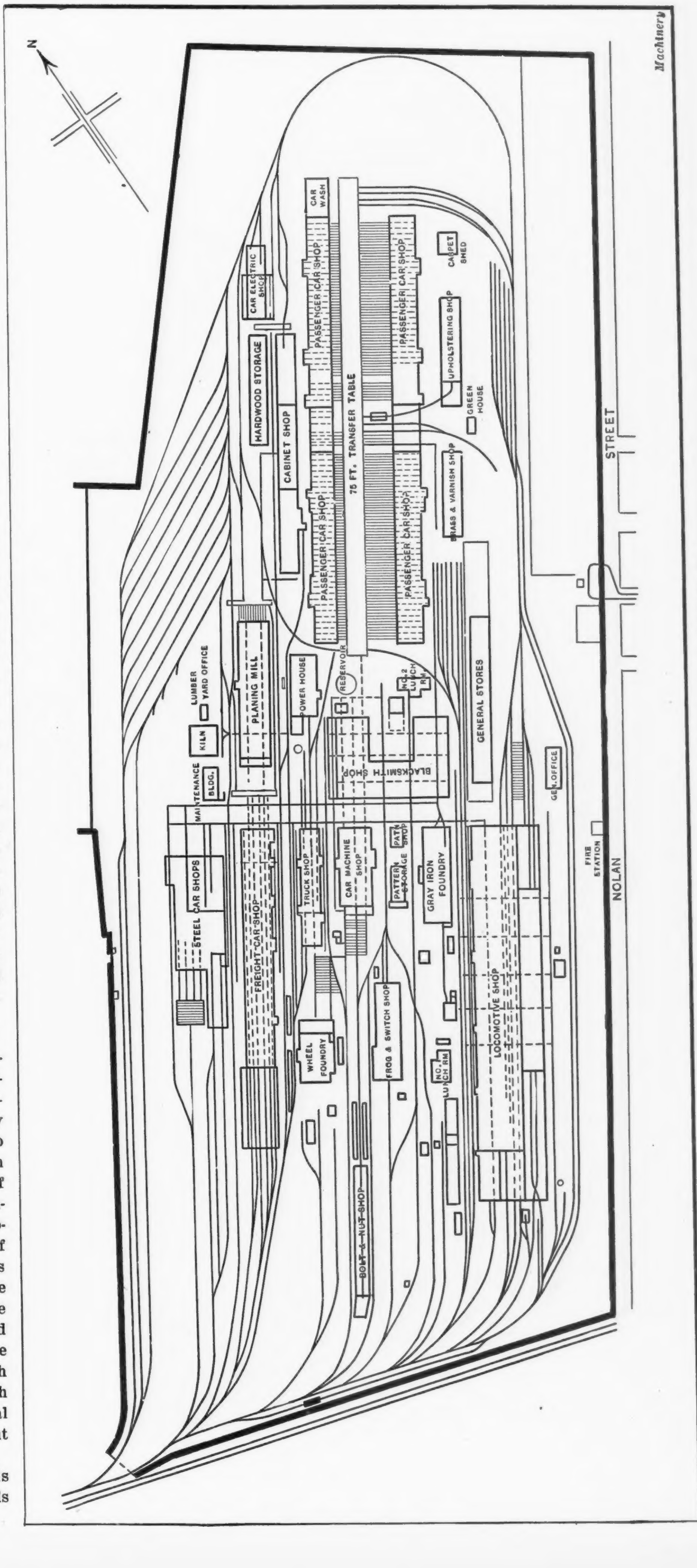
Manufacturing Car and Locomotive Parts for Stock

In line with the policy of adopting quantity production methods, as far as possible, the Angus shops are furnished with a general stores building measuring 600 by 85 feet. This building is equipped with the most approved arrangements of bins and other forms of containers, in which all classes of finished parts are stored pending their delivery to the plant on production orders or their shipment to one of the division shops of the system. In this connection it may be mentioned that a completely organized system has been evolved for the salvaging of the many classes of scrap material which accumulate on a railway, and these reclaimed parts are delivered to the store-room to await withdrawal for use in the shop departments. This subject will be discussed in detail in an article which will appear in a subsequent number.

Equipment of the Machine Shops

The same principle of streamline production that has been followed in locating adjacent departments of the plant in such a way that the work can be handled to advantage, has been observed in laying out the sub-departments of each of the shops. Another important point in expediting production is the maintenance of open aisle spaces with white lines painted on each side, and the strict enforcement of the rule that no material must be allowed to project beyond these lines (see heading illustration.) With such a lay-out, electric trucks which are used for conveying material can be run at high speed without danger of interference.

The second installment of this article will deal with special tools used in the Angus shops.



General Plan of the Angus Shops of the Canadian Pacific Railway

Reducing Costs by Die-casting

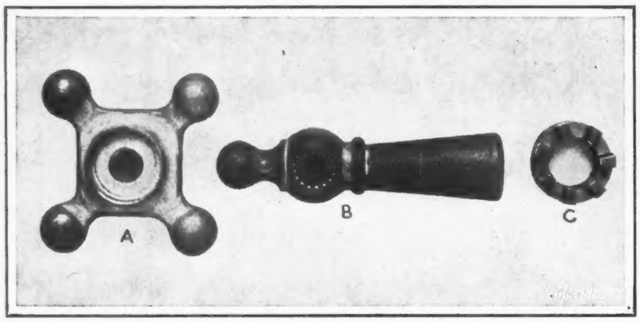


Fig. 1. Faucet Handles and Roller Bearing Cage made by the Die-casting Process

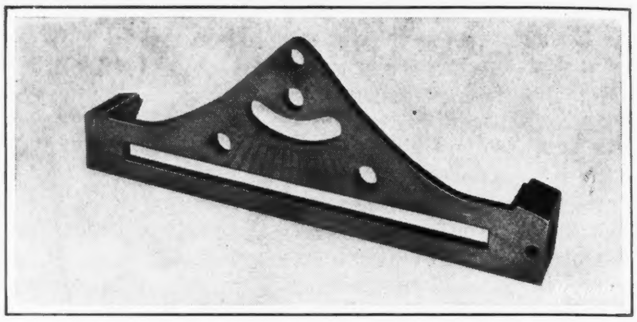
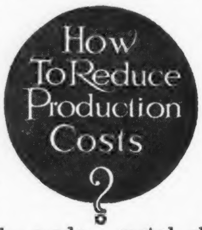


Fig. 2. Two-stand Bracket for an X-ray Apparatus, also produced by Die-casting

THE die-casting process offers many opportunities for reducing manufacturing costs, when the metals from which die-castings can be made are satisfactory for the parts required. By this process holes, recesses, etc., can be cast directly in the part being made with such accuracy that in most instances subsequent machining is unnecessary. The elimination of machining operations therefore constitutes one of the main savings in the use of die-castings. Even the first cost of the dies is negligible, as compared with the first cost of the machining equipment that would be required for making parts from steel, cast iron, or brass. In any line where die-castings can be used, therefore, their application should be investigated. Many manufacturers of specialties have found that not only is it possible to start a business for the manufacture of a new article with less capital, when the drop-forging process is employed (as the dies are cheaper than machine tool equipment), but it is also possible to get under way faster, as dies can be made in a fraction of the time that would be required for fitting up a machine shop.



It has been estimated that dies for making a given part on which a number of machining operations would be required would not cost more than 10 per cent of the cost for machinery and tools. The manufacturing of the article then reduces itself mainly to an assembling proposition and to the machining and making of such parts as cannot be advantageously die-cast.

Examples of Die-castings

The accompanying illustrations show a number of die-castings that have been manufactured by the Superior Die-Casting Co., Cleveland, Ohio, and figures indicating the saving resulting from their use will be given. Fig. 1 shows at *A* a star-shaped faucet handle. This handle costs, as delivered by the die-casting company, including the tapping operation, 65 per cent of what it cost when made from a brass casting. This includes the cost of dies distributed over a six-month period. The die-cast faucet handles are made from a zinc base alloy, having a tensile strength of 24,000 pounds per square inch. The composition is 88 per cent zinc, 4 per cent copper, 6 per cent tin, and 2 per cent aluminum. This metal is less expensive than brass, and in addition there is a saving of six machining operations, including a counterboring operation and two facing operations on each side. To prepare the brass casting for nickel-plating, it is also necessary to grind and buff it, while the die-casting needs to be buffed only. The only operations that need to be performed on the die-casting after it comes from the dies are to trim it and to tap the central hole. The counterbores on each end and the surfaces come so accurately from the dies that no further work is required except that of buffing before nickel-plating.

Faucet handles made in this manner have been used for a period of one year and have been found to be fully as satisfactory as brass handles. In fact, they have some advantages over those made from brass. They will take a heavier plate of nickel, and hence will wear longer, and if the nickel-plating wears off, the metal underneath will not show yellow, but the die-cast metal, being in the white metal class, will look more like nickel.

At *B* in Fig. 1 is shown another faucet handle, delivered at a cost of less than 5 cents, including the cost of the dies distributed over six months' production. No machining work needs to be done on this die-casting whatever. Formerly these handles had to be faced on one side, the center hole drilled and broached, and the hole for the button at the end counterbored.

At *C* is shown a roller bearing cage. In this case the die-casting costs more than the malleable iron casting that was formerly used, as there was no machining required on the malleable iron casting. However, the use of a die-casting meant a saving to the manufacturer of the roller bearings, as the die-cast cages all are uniform while the malleable iron cages are not. Therefore, in assembling the various parts, it was necessary, when using malleable iron cages, to try to fit a number of cages, which was found unsatisfactory for production work. Every one of the die-cast cages will fit, because it is possible to die-cast a part of this design within an accuracy of 0.001 inch. Thus the experience of this roller bearing manufacturer indicates the accuracy of die-castings, and shows that even in cases where the die-castings may cost more than a part made in some other manner, it might, nevertheless, be economical to use them because of other savings resulting

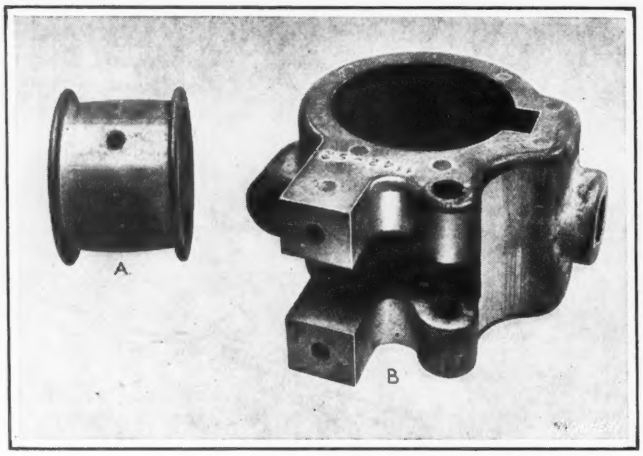


Fig. 3. Die-cast Pulley and Printing Press Part

from their uniformity and accuracy. The high rate of production obtainable in die-castings, assuring a supply of parts at all times, is also a point to be considered.

Bracket for an X-ray Apparatus

Fig. 2 shows a die-cast tube stand bracket for an X-ray apparatus. This bracket was formerly made from brass and nickel-plated. When made in this way, the holes had to be drilled and the various flat surfaces milled. The lines shown on the front of the bracket had to be produced by a graduating tool. Now this part is produced by the die-casting process, and no machining is required except the tapping of two of the holes. The large holes in each end of the bracket are in line with each other, and come accurately enough for the apparatus directly from the die-casting machine. All the holes formerly drilled are cast in place. The small holes are accurate within ± 0.0005 inch, and the rest of the holes within ± 0.001 inch. Lengthwise, an accuracy of ± 0.001 inch is assured for each two inches, and the width of the long slot is accurate within ± 0.001 inch. When zinc base metal is used for die-castings, it is generally possible to obtain a greater degree of accuracy in practically every dimension than can be obtained by ordinary machining methods, when producing work on a general commercial scale in interchangeable manufacture.

The total cost of this piece is less than the manufacturers' former cost for performing only one of the machining operations. On a comparatively small production, the cost of the die would be, say, from 20 to 25 cents per piece; but this figure is much less in comparison than the cost of the machine and tool equipment that would be required for machining a brass casting.

At *A* in Fig. 3 is shown a die-cast pulley, which was formerly made from bar stock. By die-casting, the cost was reduced 20 per cent. The feed-roll clamp *B* was formerly made from a gray-iron casting and required the boring and reaming of the large hole through it, the broaching of the keyway, the facing of both ends, the milling of the slot between the lugs, the facing of the lugs, the facing of two bosses, and five drilling operations.

These parts are now being die-cast; all holes are cast in place with sufficient accuracy without further machining, and the cost per piece is 55 per cent of the cost when a gray-iron casting was used, not including the die cost. The latter cost, however, is insignificant as compared with the cost of the machining equipment formerly required, because with a production of less than 2000 a year, the die was paid for by the first 1000 pieces through the difference between the cost of the die-casting and the machined gray-iron casting. Consequently, after 1000 pieces had been made, there was a clear saving of 45 per cent on every piece made thereafter.

The Cost of Dies

Many people do not realize that the first cost of the dies for a die-casting, when distributed over the number of parts to be made, is insignificant. The die cost that should be charged to each piece is, of course, proportionate to the quantity to be made. A die, when once made, will last almost indefinitely. The Superior Die-Casting Co. has had dies in operation for two years which have produced several hundred thousand castings, and which are still in good order. A die, for a piece of average design, would cost, say, $250. If there is a production of 5000 pieces a year, it will be seen that the die cost per piece distributed over a period of five years would be only one cent a piece.

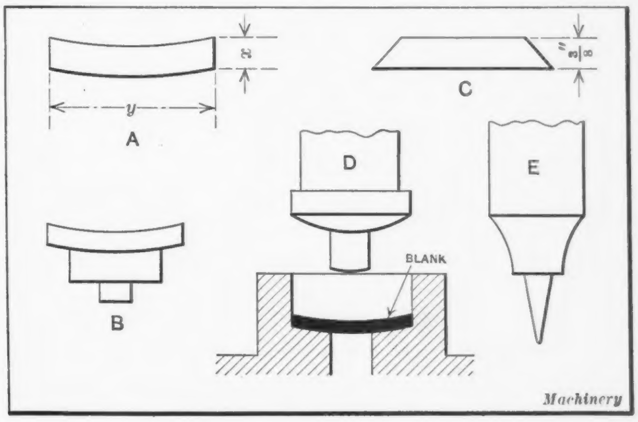
* * *

A small gas producer has recently been brought out by Gasmotoren-Fabrik Deutz in Germany, of a size suitable for yielding gas sufficient for from four to thirty-five horsepower engines. Even when not utilized to its full capacity, the power obtained by means of this small gas producer will, it is claimed, compare favorably with power obtained from central electric power stations.

MANUFACTURE OF COLLAPSIBLE TUBES

Collapsible tubes, such as are commonly used for artists' colors, are usually manufactured by the cold extrusion process. The metal from which these tubes is made is of either tin or lead composition and there is a large variety of alloys suitable for this class of work. These tubes are also often made from pure tin, and such tubes are considered superior to those made from the various compositions. The tubes are extruded from blanks of the shape shown at *A* in the accompanying illustration, punches and dies of comparatively simple design being employed. If a blank is to be drawn direct, the punch may be of the design shown at *D*. However, if a punch such as shown at *E* is to be used, it is necessary to perform a preliminary operation of forming the blank to the shape shown at *B*. Collapsible tubes vary in thickness from 0.005 to 0.010 inch, and the maximum size produced is 2½ inches in diameter by 9 inches long.

A blank of the type shown at *A* when x equals ¾ inch and y 4½ inches, can be drawn to a tube ¾ inch diameter by 4½ inches long, and will require a pressure of approximately 30 tons. When x equals 7/32 inch and y 1 inch,



Blanks from which Collapsible Tubes are extruded, and Types of Punches used

the size of tube will be 1 by 6 inches, and the pressure required, 42 tons. For a 1½- by 7-inch collapsible tube, x should be 5/16 inch and y 1½ inches, and an applied pressure of 84 tons should be used. In extruding a 2- by 8-inch tube, x equals ⅜ inch and y 2 inches, and the pressure required is 130 tons.

Caps for bottles, such as catsup bottles, are made from soft metal blanks, sometimes by the extrusion process and sometimes by rolling and forming the blanks. The usual method is to cast the blanks into the shape shown at *C*, and then to roll the metal to 0.078 inch in thickness and to cut out from this rolled material a 1-inch diameter blank. From this blank the cap is drawn to a wall thickness of approximately 0.010 inch and to a thickness of head of about 0.014 inch.

An alloy which will be found suitable for both collapsible tubes and soft metal bottle tops, consists of 4 ounces copper, 6 ounces antimony and 16 ounces tin, melted together, the resulting alloy being used with varying quantities of pig tin. For collapsible tubes 50 ounces of the alloy and 200 pounds of pig tin are used; for bottle tops, 134 ounces of the alloy and 200 pounds of pig tin. Any one of the three following compositions may also be used successfully in the manufacture of collapsible tubes: (1) antimony 14 per cent and tin 86 per cent; (2) antimony 5 per cent and tin 95 per cent; (3) copper 2 per cent and tin 98 per cent.

* * *

Of the forty-one tractors shown at an exhibition of agricultural tractors and accessories in Paris in the earlier part of the year, 19 were American, 18 French, 1 Italian, 1 English, and 2 Czecho-Slovakian.

Saving Time in Assembling

Examples Showing Savings Resulting from Investigation of Assembling Methods

By ALBERT A. DOWD, President, and FRANK W. CURTIS, Chief Engineer, Dowd Engineering Co., New York City

How To Reduce Production Costs?

IN quantity production, it is possible to perform manufacturing operations on parts at a comparatively low unit cost, yet the time consumed in the assembling department may be so great that the cost of the complete mechanism is increased much more than it should be. The efficient factory investigator makes a special study of methods used in the assembling department in order to reduce costs and increase production. If the production costs are high, the investigator may conclude to start his survey in the assembling department and work backward from this point, being governed more or less by conditions as he finds them. For example, as the various parts of the mechanism come to the assembling department and the workman starts to put them together, a certain piece is found to be a little too tight, and therefore must be touched up with a file before placing it in position; another piece has a burr along one edge, which must be scraped or filed off before assembling; the alignment of certain holes is not accurate enough and a line-reaming operation is required; or one surface of a part is not square with another, and the part must be refinished or scrapped, depending upon the seriousness of the error. Often parts must be scraped to a fit at assembly when proper machining would avoid the necessity for this.

Examples Showing Sources of Expense and their Remedies

In order to illustrate this point and bring it home more forcibly, several examples are here given with the remedies that were applied. An aluminum gear-case is fitted with a cap held down by six nuts placed on studs inserted in the case. The studs are assembled in the case by a workman using a stud setter, and formerly when the cover was applied and the nuts were put in place, some of the studs turned as the nuts were tightened, because the studs were too loose a fit in the tapped holes. This condition caused much annoyance and delay. An examination to determine the source of the trouble revealed a difference of from 0.002 to 0.004 inch in the stud diameters, some being made on one machine and some on another. One machine was producing work within the required limits, while the other turned out undersized studs. The remedy here was a more careful inspection which resulted in changes in the dies that produced the small studs. A matter of this sort would often be neglected and a great amount of time consumed in removing and replacing studs, which represents a needless expense.

Another case in point is that of a shaft assembled in a gear-box and running in bronze bushings. Although the hole in the bushings was inspected with a plug gage and found to be within the required limits, when the shaft was assembled it did not turn freely. In order to remedy the trouble the workman was obliged to ream one of the bushings with a hand reamer. This is a peculiar instance, yet an examination showed the reason to be that the holes in the bushings were slightly eccentric with the outside diameter. In some cases the bushings were assembled in the box with the eccentric portions in the same relative positions, and under this condition the shafts would enter all right and turn freely; but, when the eccentricity of the two bushings was in opposite directions, too tight a fit was the result. The remedy for this condition was found to be a change in the method of producing the bushings so that concentricity was obtained.

Another example of high cost remedied by a careful investigation of methods employed in the assembling department was a printing press platen which was scraped to alignment in the assembling department after being placed in position on the machine. The time consumed for this operation appeared to be excessive, and a careful inspection showed imperfect alignment and a surface slightly warped. Tracing the various operations back through the manufacturing departments it was found that the trouble originated in the planing department, the planers being old and inaccurate so that untrue results were obtained. The method of holding the work during the operation was also found to be incorrect, causing distortion and inaccuracies. The planers were overhauled and trued up, with the result that a saving of two days' time on each machine was effected when assembling, and much fitting was avoided.

Other matters that affect costs can be found by a careful investigation in the assembling department. Some of the points referred to may seem to be small matters, yet they are important on account of the time that can be saved by attending to them properly. For example, racks for screws, bolts, and other units used, and the placing of parts convenient to the workman, are matters of importance. Much time is saved by good arrangement of parts, and as the workman does not become so tired, he does more work. Accessories such as stud-setters, power-driven screw-drivers, and socket wrenches save time and help to obtain maximum production.

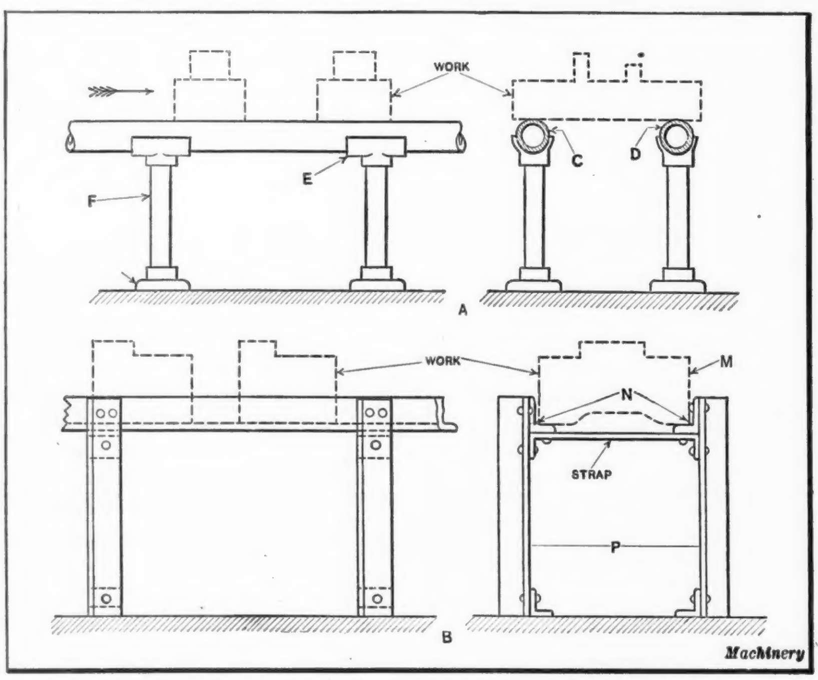


Fig. 1. Two Simple Designs for a Plain Assembling Conveyor

Matters Affecting Assembly

In determining the best method for assembling a given unit, several important factors must be considered. Conditions are quite different in a small shop with a low production from those in a large factory having a high production. The number of units to be produced is, therefore, an important factor, yet it does not necessarily follow that the assembling department should be neglected when only a small production is to be handled. On the contrary, "trimming the corners" by saving labor in assembling will reduce costs and stimulate production.

The amount of final fitting in assembly must be reduced to a minimum, as otherwise work will be done which should be taken care of in the manufacturing departments. The final fitting of parts should be watched closely by the assembling department foreman, and work which requires unnecessary fitting should be sent back to the inspection department with a notation as to the requirements. The inspection department should return the work to the department responsible, in order that it may be refinished to the size called for on the drawing. It is possible that the gages used in the inspection department may be worn or sprung out of shape so that parts made incorrectly pass inspection. In rare cases the engineering department may be at fault due to an incorrect setting of limits on the drawings. This trouble is not commonly found until the final test of the mechanism, at which time the necessary recommendations can be referred to the engineering department.

Methods Used in Assembling

Many manufacturers do not consider the assembling of their product important enough to devote much study to improvement of methods used in this department, and there are numerous cases where workmen are left to their own devices and methods. One man out of ten may develop a good method, while the other nine work more or less profitably, according to their ability and general knowledge of the work. Progressive manufacturers realize the importance of keeping down assembly costs, and study the problems involved. A system of assembling is fully as important as an efficient method of production. When an investigator attempts to put into practice knowledge gained by experience, he is likely to meet with opposition from the men who should give him assistance. It is natural that any man familiar with a certain job of assembling should consider that he knows more about it than another man who sees it for the first time. He should not forget, however, that an investigating engineer is examining his work from a different angle and trying to devise means for doing it in an easier way and with less consumption of time.

In considering the various operations in an assembly department, an analysis of the number of movements a man makes, the number of times he is obliged to turn the mechanism over and his methods of inserting various units and holding them in place while putting in locating pins, nuts, or bolts should all be the subject of careful observation. It may be found that though a man is working conscientiously, he is handling the unit unnecessarily, so that often economies can be effected by the use of an assembling stand to assist in turning the device into different positions to make it easier of access. The need for a stand depends on the number of units produced, the size of the parts, and the difficulty in handling. For moderate production of small units, assembling stands are seldom necessary, but on larger work they may be found an advantage. When production is high, assembling stands or conveyors can be used to increase production. Assembling stands for various units are more or less expensive, but in some cases a simple wooden frame made at a nominal cost, will materially help production.

Assembling by the Conveyor Method

The advantages of conveyors and racks in the assembling of various products are not appreciated by many manufacturers, and when a conveyor is suggested for purposes of assembling, the manufacturer generally thinks of the large cost of installation and believes it necessary to reorganize and change his methods completely with a loss of considerable time. He also thinks of the possibility that the system may not prove successful after installation. In many large factories, however, the system has been developed to a wonderful degree, and there is no question as to its efficacy. A few specific cases which bring out the principles of the various types of conveyors for assembling, their use, application and advantages, will be given to show how important conveyors are and how easy it is to install the simpler types. It is evident that a conveyor system would hardly be needed in a factory where two or three men are sufficient to do all the assembling; yet even here there are possibilities of changes which would relieve these men for perhaps a part of their time so that they could work on some other operations. The points of importance to be considered when planning a conveyor or assembly line are as follows: Nature of the product, production, number of men needed in assembly, and time of each operation. The nature of the product determines the size of the conveyor and its general shape in accordance with the number of units or pieces which are to be assembled. It may be better to use two conveyor lines rather than one in order to avoid the length taken by too long a conveyor. The speed of a power-driven conveyor should be governed by the production required. It would not be good practice to design a conveyor to run at such a speed that a single operation would require an operator to move ten or fifteen feet, as this would be tiresome and the greatest efficiency would not be obtained. The number of men required is dependent upon the product and the spacing and apportioning of the operations so that they will time up with each other. The speed of the conveyor should be such that the operators do not interfere with each other, nor should one man have more work to do than another. The time of each operation is generally predetermined by the old method, although by the conveyor system there may be a slight gain in time, as the operator has only one thing to do, and consequently he becomes exceptionally expert in doing this particular thing.

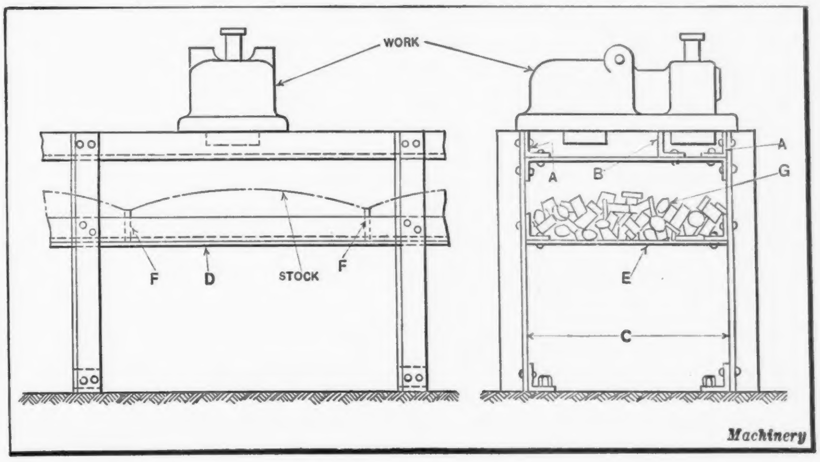


Fig. 2. Plain Assembling Conveyor having Compartments for the Stowing of Parts

Plain Type of Assembling Conveyor

A conveyor for assembling is usually designed to suit a particular product, although it is possible to standardize the construction so that it can be adapted to a number of kinds of work. The principal types which will be considered are the plain, roller, and power types. Fig. 1 shows at *A* one of the simplest forms of conveyors for assembling. This type is made up from pipe of suitable size and simple fittings

which can be easily made and require little machining. The work rests on two lines of pipe C and D, which are spaced a suitable distance apart according to the width of the product. The pipes rest in cast-iron sockets E that are screwed to the upper end of short lengths of pipe F. Substantial cast-iron bases hold the lower end of the pipe, and these castings may be fastened to the floor or made heavy enough so that their weight is sufficient to hold them in position. The spacing of the uprights is determined by the size of pipe used and the weight to be carried. In using this type of conveyor, the assembler finishes a given operation on the part and then pushes it along the pipe to the next workman who does another portion of the assembling. This type of conveyor is suited to work of fairly good size not likely to be pushed off one side. There are no protecting guides, the workman being required to exercise sufficient care so that they are not necessary.

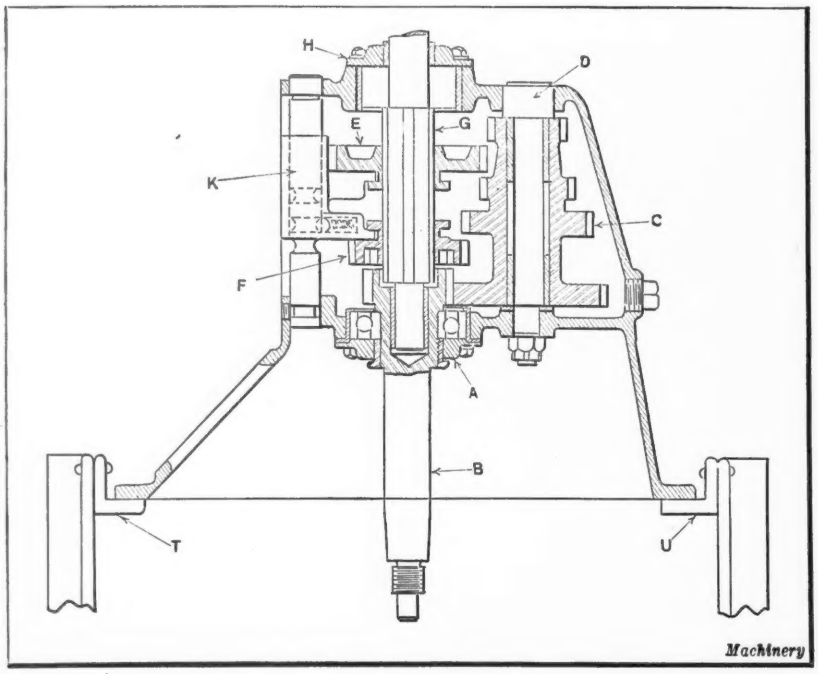


Fig. 3. Sectional View of Transmission Case assembled by the Conveyor Method

Another simple type of conveyor is shown at B; this form is composed entirely of angle-irons and straps. The dotted lines M indicate the piece of work to be assembled. The work is slid along from one operator to another in the guides formed by the legs of angle-irons N. These are set far enough apart so that the work will slide easily and yet cannot fall off. The uprights P are also composed of angle-irons with suitable reinforcements at the foot to allow them to be bolted to the floor if desired. When the work rests on a finished surface it may be found advantageous to place a strip of fiber or leather on top of angle-irons N for the purpose of keeping the finished surface from marring.

In order to obtain the greatest efficiency from the conveyor method of assembling parts, the operators' convenience should be carefully studied in order to make their movements as few as possible. In Fig. 2 is illustrated an angle-iron type of conveyor somewhat similar to the one previously mentioned. In this case, however, the work rests on the edges of the angle-irons A, a guide strip being placed at B to prevent it from being pushed off the conveyor. Uprights C are also angle-irons and between these, angle-irons D extend longitudinally and carry a plate E on which are placed a number of parts used in assembling. Suitable partitions F are inserted so that each workman's parts are kept separate from the others. In assembling, an operator simply reaches down and selects a part from the pile G, while the next operator has a similar pile of other parts which he uses when the work is pushed to him. This method allows an operator to work rapidly, and a high production rate is obtained.

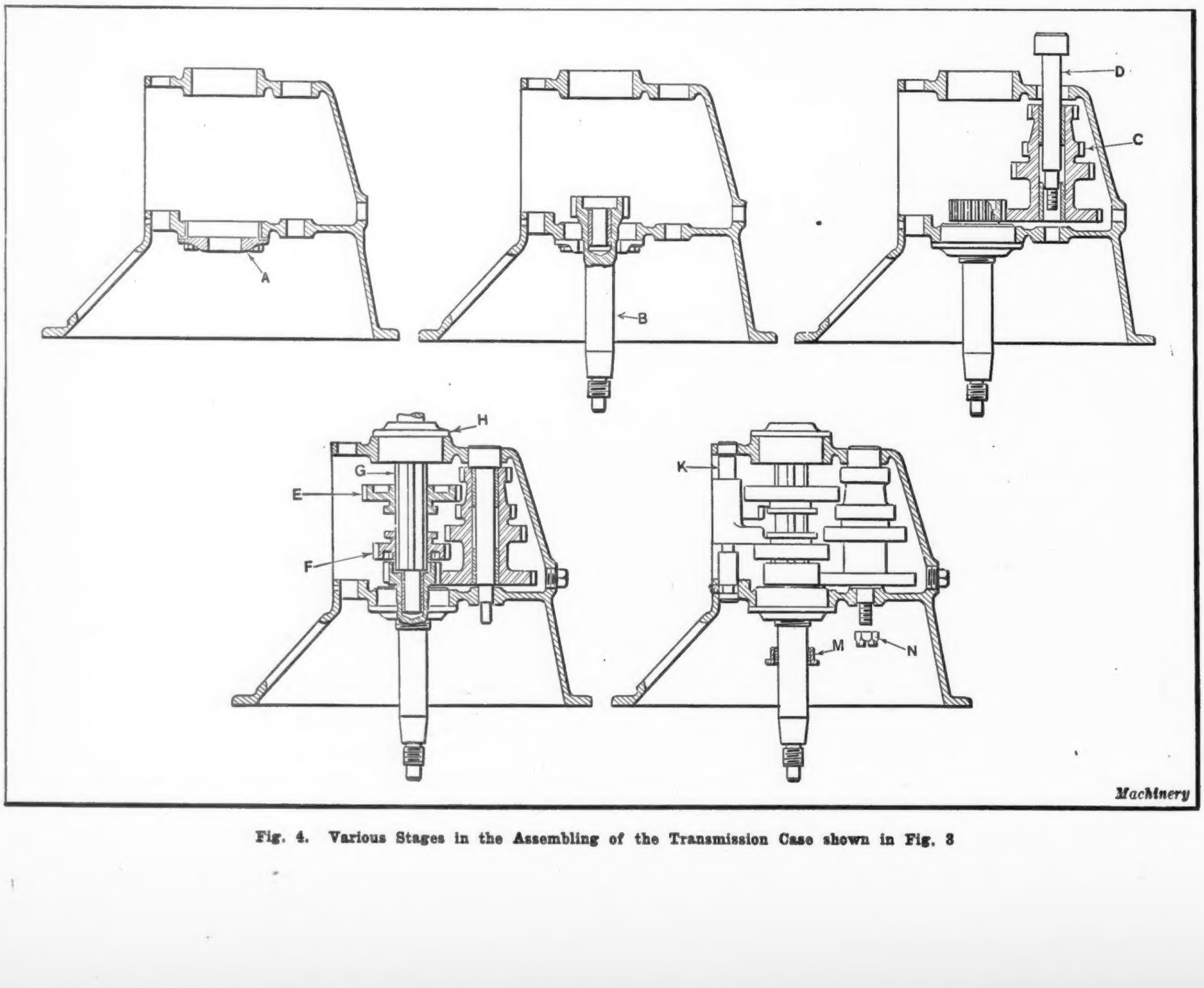


Fig. 4. Various Stages in the Assembling of the Transmission Case shown in Fig. 3

Roller and Power Types of Assembling Conveyors

The roller type of conveyor is not used much in actual assembly but rather for conveying parts from one position to another. For heavy work rollers having ball bearings allow the product to be moved very easily. The cost of such a conveyor is higher than that of a plain type, but its advantages for certain kinds of work offset the difference in cost. This form of conveyor is not generally used in assembling, as it is hard to keep the work steady enough so that parts can be placed in position with certainty.

The power type of conveyor is most commonly used in large manufacturing plants. In this type a chain or belt carries the work along at a uniform speed, and the workman who does the assembling walks with it when placing the various parts in position. The speed of the conveyor is so arranged that each workman has a given amount of time to do a certain operation, and the various jobs are carefully proportioned so that one man does not have more to do than another. The advantage of this form of conveyor is that the manufacturer knows exactly how many units he will obtain in a given length of time, as the parts are not moved with respect to the conveyor and they travel at a uniform speed. When this method of assembling is adopted, each operator is obliged to keep up with the speed of the conveyor, as the next man is always waiting for the part to come to him.

A conveyor of this sort can be designed to hold a considerable amount of stock in various locations. Provision can also be made for turning the work over in order to assemble units on either side. In cases where it is necessary to perform a machining operation after a certain amount of assembling has been done, the conveyor can be designed so that the work can be slid on a sheet-metal table at the level of the machine table on which the operations are performed. After the machining operations, the work can be slid back on the conveyor for further assembly. If the length of time necessary for assembling is such that a conveyor would be required longer than the length of the building, it can be turned around corners and returned in the opposite direction.

Examples Showing Savings Resulting from Conveyor Assembling

In order to make the actual savings obtained by the use of a conveyor system of assembling more apparent, two specific examples will now be presented. Fig. 3 illustrates a transmission case assembly which had in times past been assembled on a bench. A number of men were employed on this work, and each man assembled and tested a complete unit. The work was picked up from the floor and placed on a bench, after which the different parts were taken from conveniently placed racks and assembled in the case, one at a time, bolts being tightened by hand and all adjustments made so that the unit, when finished, was ready for the final inspection. The time necessary for assembling a complete mechanism was twenty minutes.

An investigating engineer decided that this method was entirely too slow and, therefore, installed a conveyor arranged with angle-irons as shown at *T* and *U* which served to support the work and acted as guides. The work is placed on one end of the conveyor in the form shown at the extreme left of the top row in Fig. 4, the bearing cap *A* having been assembled in a previous operation. The first workman places the combination shaft and pinion *B* in position and pushes the work along to the next man, who assembles the shaft in its bearing and makes a superficial test to see that it runs properly. The next man places the gear *C* in the case and sets shaft *D* in position. After this, another operator drives the shaft *D* home and makes sure that the gears mesh correctly and revolve freely. The next step is the assembling of sliding gears *E* and *F* on shaft *G* by an operator who simply places the parts in position but does nothing more. The next man adjusts the parts, sees that they move freely, and places the bearing cap *H* in position, at the same time placing the bolts in the holes to secure the bearing cap. The next workman uses an electric drill provided with a socket wrench and rapidly screws the bolts into the nuts, the work being then passed to another operator who tightens the nuts by hand. The next operation is placing the gear-shifting shaft *K* in position and testing the gears to make sure that they move freely. After this has been done, another operator turns the work over and places bushing *M* and nut *N* in position. The last workman adjusts bushing *M* and tightens nut *N*, thus completing the assembly. A comparison of the two methods shows that it required twelve men using the new method to produce sixty pieces per hour, while the old method required twenty men for the same production. The cost of the conveyor was nominal, as the construction was very simple and standard angle-irons were used.

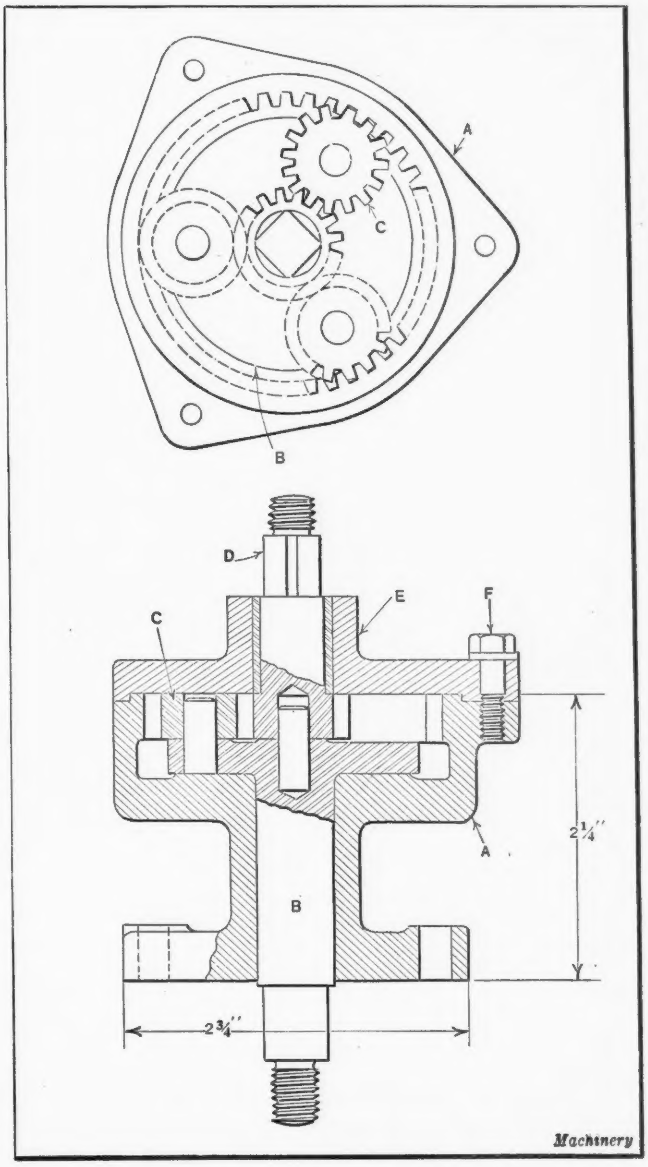


Fig. 5. Sectional View of a Triple Gear Unit which was assembled by Means of a Power Conveyor

Assembling a Gear Unit

An investigation was recently conducted in a shop in which a triple gear unit was one of the products. A sectional view of this part is shown in Fig. 5. The production wanted was six hundred per eight-hour day. After carefully inspecting the methods of machining and improving these where it was found desirable, the assembling was considered. It was found that three men assembled the parts at the required rate of production and that the superintendent considered that this was satisfactory. One man assem-

bled the parts while the others tightened the nuts, the average total time consumed for one piece being 2.4 minutes. The mechanism consists of a body *A* in which a flanged shaft *B* is contained. Three gears *C* are assembled on pins equidistantly spaced in the flange of shaft *B*, these gears meshing with an internal gear cut on the inside of body *A*. Shaft *D* has a pinion cut on one end, and this also meshes with gears *C*. A cover plate *E* is fastened to the body by means of three bolts *F*, each of which has a spring lock washer. The assembling is quite simple and no fitting is required.

After studying the old method, it appeared that a conveyor could be easily applied with a distinct gain in production, and so a study was made of the length of time necessary to assemble each of the parts by the old method. This gave a basis for comparison and an idea as to the speed at which the conveyor could be run. A preliminary sketch of the idea was made, and as it appeared worth while, the idea was put into practice as illustrated in Fig. 6. The two pulleys *G* and *H* were mounted in a wooden frame set on the floor, and motor *K* was connected to drive pulley *H*, the reduction being such that the surface speed of the canvas belt *L* permitted time for each man to assemble his portion of the work. Belt *L* was furnished with a series of blocks *M*, spaced at intervals of 3 feet. In each block a hole was bored to allow space for the central shaft of the unit when assembling. The work is located on studs projecting from blocks *M*, which hold it in position so that assembling can be done readily. The belt slides over the top surface of table *Q* which eliminates sag.

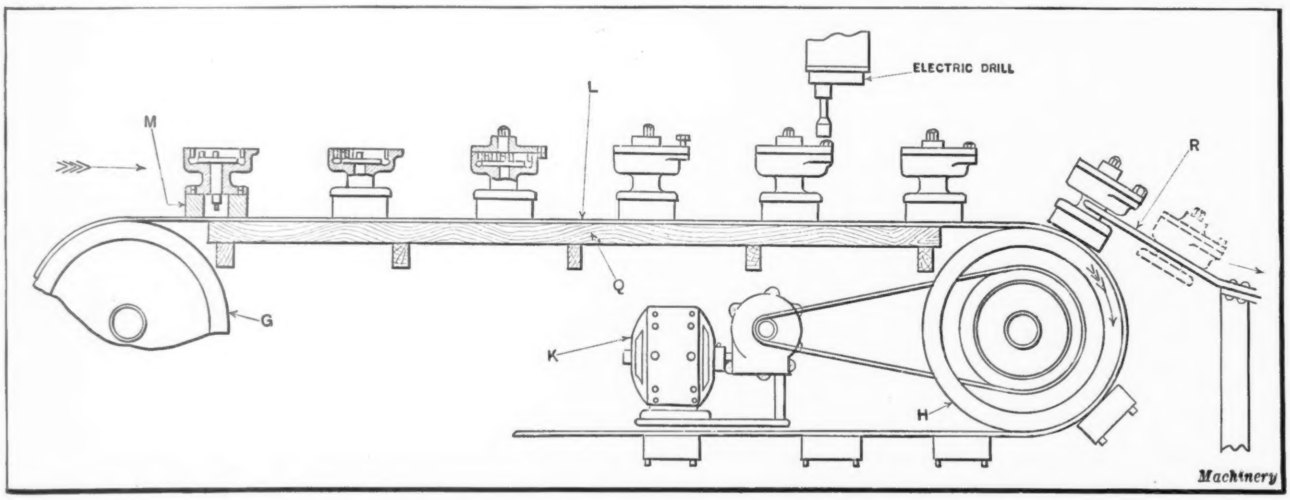


Fig. 6. Motor-driven Belt Conveyor used in assembling the Triple Gear Unit shown in Fig. 5

In the first operation a man places the work on the two studs and assembles the part *B*, Fig. 5, in position. The next workman places the three triple gears *C* in place, while in the third position, the central pinion *D* and the cover *E* are assembled. In the fourth position the three bolts *F* and their lock-washers are put in place, and in the fifth position an electric drill suspended over the conveyor is brought into place to tighten these bolts loosely by means of a socket wrench. In the sixth operation, a workman tightens the bolts by hand. Immediately after this operation the work passes over the pulley, at which time it is guided between the plates *R*, Fig. 6, and slides down an incline ready for inspection.

In addition to the mechanism shown a bench was provided on one side so that any defective parts could be set aside and replaced by a new part. The percentage of defective parts, however, was small, due to accurate machining. After the workmen had become familiar with the new method it was found that by running the conveyor one hour a day and employing six men, the desired production was obtained and the men liked the change from their work at the bench. The amount of space required was small, and the total cost of the equipment moderate.

By comparison, the time required per piece in the old method was found to be excessive, as is clearly shown by the following figures: Old method, 2.4 minutes per piece; new method, 0.60 minutes per piece; old method, 600 pieces required 1440 minutes; new method, 600 pieces required 360 minutes. The saving in time equals 75 per cent. This is a good example of the economies which can be effected by the judicious use of conveyors in assembling. The small manufacturer should not attempt to install a complicated system of assembling conveyors, but he can save a great deal of money by using simple forms like those described.

* * *

MOVING PICTURES OF MACHINE TOOLS

The educational value of motion pictures for teaching students of trade schools and colleges is coming more and more to be appreciated, and this is emphasized by the fact that the United States Government is now having motion pictures of machine tools taken, which are to be used for educational purposes in twenty-seven vocational schools throughout the country. The pictures are being filmed by the Society for Visual Education, and a ten-thousand foot film relating to milling machines has been taken in the shops of the Kempsmith Mfg. Co., Milwaukee, Wis. This film shows the assembly of the different parts of a milling machine into units, the assembly of the units, and the complete assembly of a machine. Then follow pictures of various milling operations, ranging from those of a simple nature up to complex operations requiring the use of a dividing head or special attachments. The cutting of gears is also presented. Close-up views of the revolving cutter in ultra-rapid pictures indicate clearly the manner in which the cutter tooth cuts into the metal and removes a chip. A series of such pictures should be of considerable interest to the student of machine shop practice.

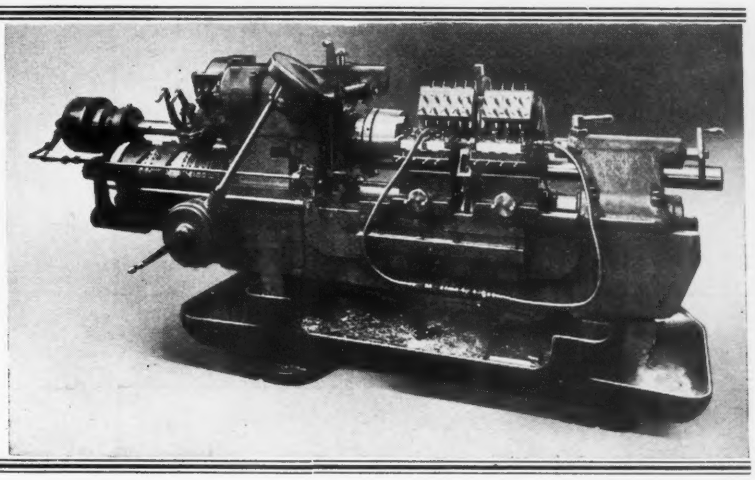
* * *

STANDARDS FOR TESTING WELDS

The American Welding Society, 33 W. 39th St., New York City, has issued a bulletin entitled "Standards for Testing Welds," consisting of a report of the Committee on Standard Tests for Welds of the American Bureau of Welding, which is a joint advisory board of the American Welding Society and the Engineering Division of the National Research Council. Differences in the procedure of testing welds in the past have caused widely divergent results, and comparisons are frequently impossible, with the result that the usefulness of much of the research work on record becomes limited, and in many cases the results are actually misleading. The committee feels that the need for some immediate standards is great, and the universal use of the specifications contained in the bulletin is urged upon all those who have to do with the testing of welds.

Cost-reducing Tooling Equipments

Tooling Equipments Employed for Machining Steering Knuckles and Other Automobile Forgings at a High Rate of Production



By RALPH E. FLANDERS
Manager, Jones & Lamson Machine Co.
Springfield, Vt.

MACHINE tool developments, during the last decade, have been influenced to a remarkable degree by the automobile industry in the establishment of the high productive and efficient manufacturing methods now followed by most of the concerns connected with the industry. The present-day trend in the design of machines for performing lathe operations is either to provide the machine with several work-spindles and a corresponding number of tool positions, as on multiple-spindle automatic screw machines, or to provide one spindle and as many tools for taking simultaneous cuts as the work will stand without chattering or springing. The present article describes the turning of forged parts according to the second method referred to on automatic lathes produced by the Jones & Lamson Machine Co., of Springfield, Vt.

How To Reduce Production Costs ?

The machining of steering knuckles is typical of the jobs handled on the Fay automatic lathe. The tooling equipment used on this machine for one type of steering knuckle is illustrated in Fig. 3. The knuckle is centered on the axis of the wheel-spindle. The center at the large end is drilled to a uniform depth, as gaged in the centering machine from any support on the forging which will locate the bosses for the holes. The front tool-holder of the lathe feeds in at an angle, until the proper depth of cut is reached, and then feeds straight toward the left, the three tools finishing the two ball seats of the knuckle, ready for grinding, and the small end, ready for threading. Meanwhile, the two tools in the rear tool-holder take a roughing cut on the tapered portion, the length of the cut being divided between them, so that what would otherwise be the longest feed of the operation is considerably shortened. A supplementary holder beneath the rear holder also rocks into place so that the two tools held in it bevel and neck the small end to prepare it for a threading operation. All the tools on the machine work simultaneously.

Fig. 1 illustrates a similar job except that the small end is not necked and the bevel on this end is produced by a tool in the front holder. A designer can usually arrange to omit this neck, and so simplify the tooling for an operation of this sort. Only a roughing cut is needed on the steering knuckle, because the two ball seats are ground later. The forging shown in the machine in Fig. 1 is machined at the rate of about forty per hour, so that over 700 parts are produced in a nine-hour day by one

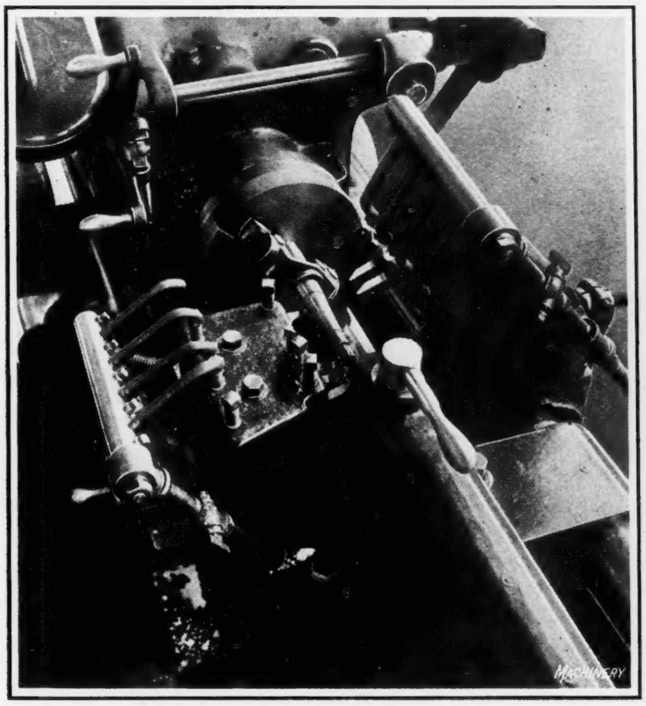


Fig. 1. Automatic Lathe furnished with Necessary Tooling for the machining of a Steering Knuckle

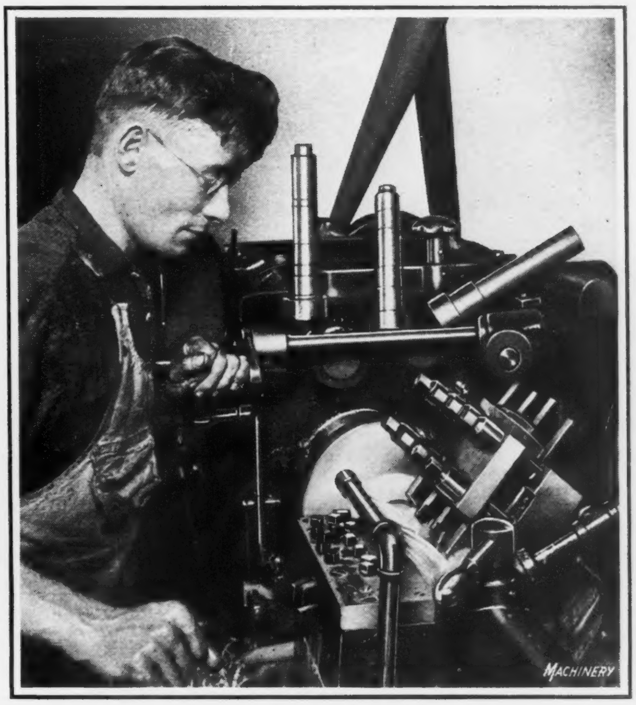


Fig. 2. Coolant being supplied copiously on a Machine equipped with Intensive Tooling

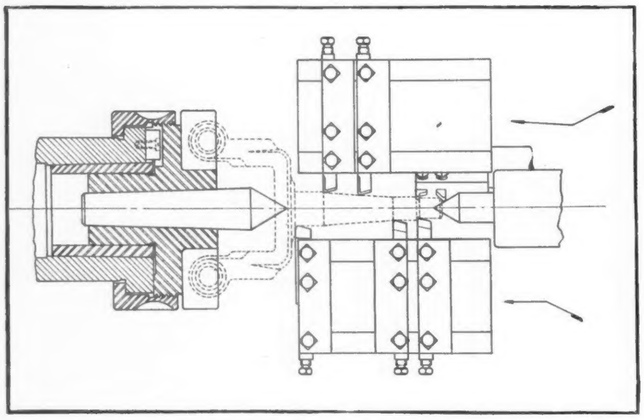


Fig. 3. Rough-turning Automobile Steering Knuckles on a Fay Automatic Lathe

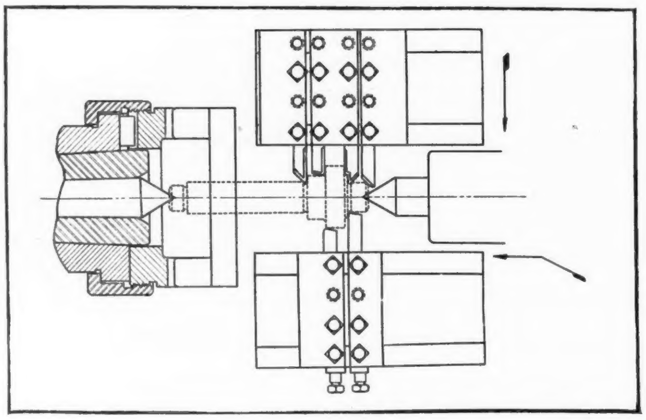


Fig. 4. Tooling Equipment provided for the First Operation on a Transmission Shaft

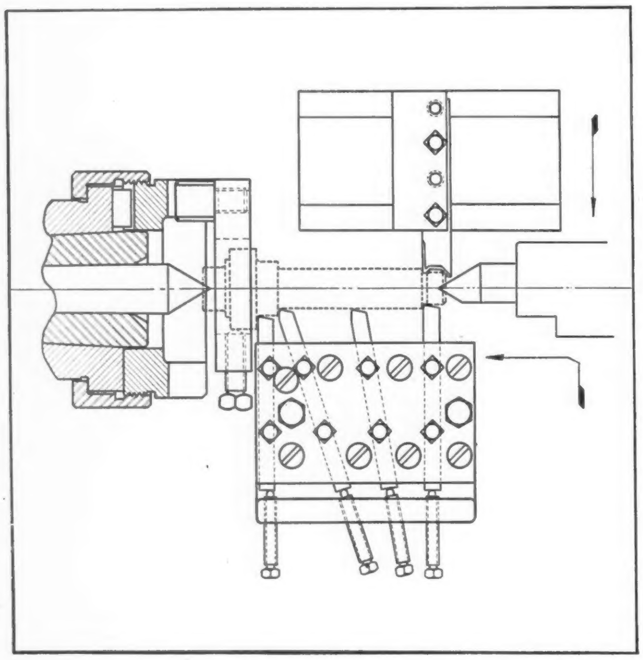


Fig. 5. Second Operation on the Transmission Shaft illustrated in Fig. 4

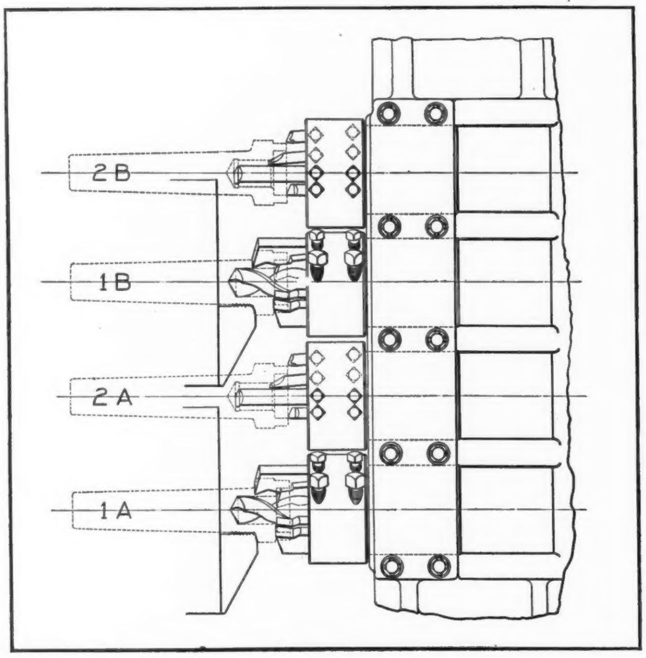


Fig. 6. Machining a Clutch Shaft on a Double-spindle Production Lathe

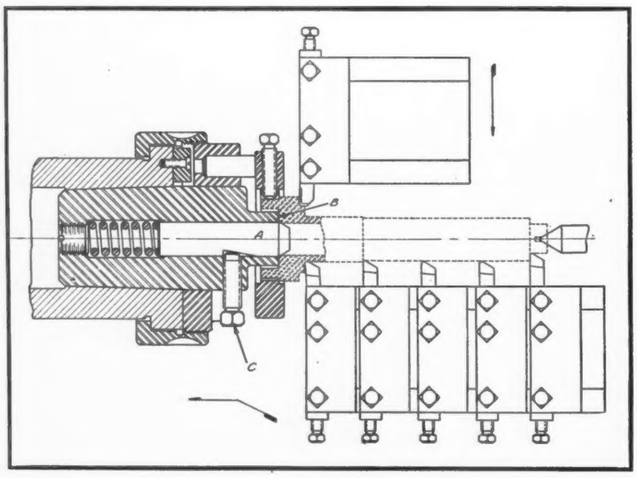


Fig. 7. Tool Set-up used in rough-turning Transmission Clutch Shaft

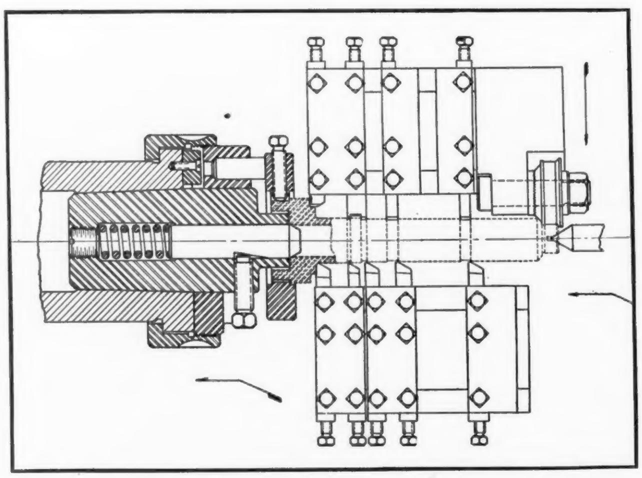


Fig. 8. Finish-turning Operation on the Shaft shown in Figs. 6 and 7

operator running two machines. The steering knuckles shown are of the forked type used with a T-headed front axle, but the tooling of the machine and the production would be the same with a T-type knuckle for a forked axle.

Tooling Equipments for a Transmission Shaft

Transmission shafts are also readily turned on Fay automatic lathes. The example shown in Figs. 4 and 5 is a lower or jack shaft having an integral pinion. With close-forged blanks of mild steel, a single cut over each surface is all that is necessary to prepare the part for the grinding and threading operations. With inaccurate forgings, however, and particularly with those made of tough alloys, roughing and finishing cuts must be taken over each surface. When two cuts are necessary and only two machines are available, it is best to run a lot through both roughing operations first, and then, without changing the camming of the machine, through both finishing operations.

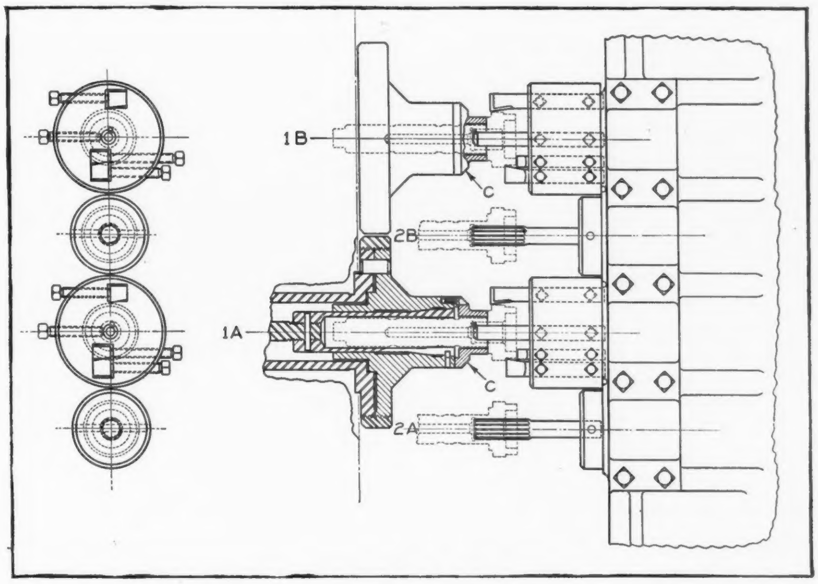


Fig. 9. Equipment provided on a Double-spindle Production Lathe for machining Transmission Clutch Shaft

All such parts as these are best handled if the ends are straddle-milled to length in a preliminary operation, gaging from the pinion blank, and then centered to a standard depth. This procedure saves facing into the centers and provides a smooth surface to center into as well. A rugged inexpensive machine for straddle-milling the ends of such work as forged shafts should find a ready sale in automobile factories. A simple gage for determining the depth of centers was shown at *C*, in Fig. 1 of an article describing the production of tractor camshafts, which was published in May, 1920, MACHINERY. The use of this gage in connection with straddle-milling permits work of ordinary accuracy to be put into the machine, taken out, and turned end for end in a second operation, without altering the positions of the shoulders. Longer forgings may be machined in the same manner as the shaft described, although it may be necessary to provide additional support at the middle of the work by the use of a steadyrest.

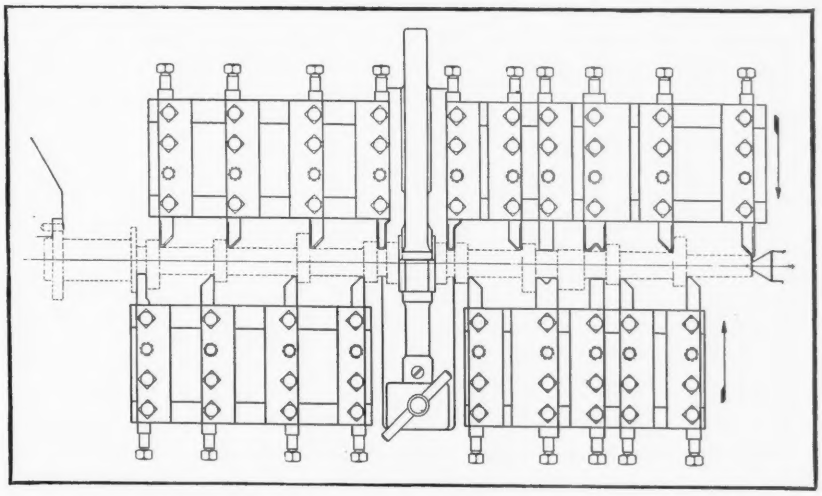


Fig. 10. Tooling provided on a Fay Automatic Lathe for squaring the Shoulders of Camshafts

Machining a Transmission Clutch Shaft

The first operation on a transmission clutch shaft is performed on a double-spindle production lathe equipped with the tooling shown in Fig. 6. Both spindles are fitted with an air-operated chuck for holding duplicate pieces of work, and two sets of tools simultaneously finish the two pieces in practically the same time as would be required for machining one piece in a single-spindle machine. When the carriage is fed forward, after the work has been chucked, the holes are drilled and counterbored and the two outside diameters of the large end are rough-turned, as shown at positions 1A and 1B. The carriage is then withdrawn and an automatic mechanism shifts the tool-slide over to bring the second set of tools, shown at positions 2A and 2B, into alignment with the work. As the carriage is again fed forward to its stop, two tools bevel the bottoms of the counterbores to form centers. Then, the tool-slide is fed toward the rear for a distance of about 3/16 inch to bring two tools into position to rough-face the end of each piece of work, the cut being divided between them as one tool works toward the outside and the other toward the center of the part. Meanwhile, a tool recesses the bottom of the drilled hole. If the forgings are straddle-milled prior to this operation, the facing tools can be omitted.

Figs. 7 and 8, respectively, show the roughing and finishing cuts on this part, which are taken in a Fay automatic lathe. The point of particular interest is the method of supporting, locating, and driving the work. The work is centered on a spring plunger *A* which recedes as the tail-center is advanced, until the bottom of the counterbore in the work comes in contact with the end of part *B*. All the cuts are thus gaged from the bottom of the counterbore, which is the logical place. Set-screw *C* is then clamped to hold parts *A* and *B* in the proper relation to each other. Attention is also called to the arrangement of the tools in the front holder; it will be seen that the machining of the shank is divided between four tools, so that the rough-turning is completed in about one-quarter the time that would be necessary with one tool.

Rigid support of the work at the headstock end is an essential feature in withstanding the pressure of these multiple cuts. On most work, it is advisable to use a revolving ball-bearing center in the tailstock, as otherwise the center hole will wear so badly as to

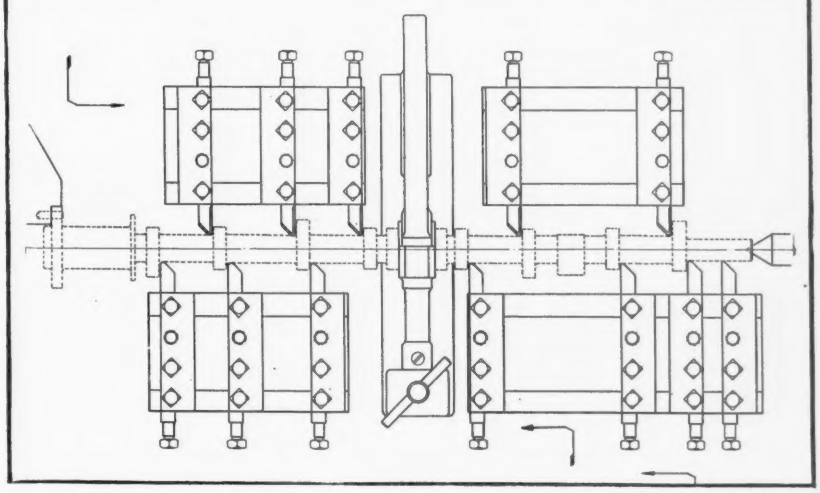


Fig. 11. Turning the Camshaft, the Cuts being divided between Tools in the Front and Rear Holders

allow the work to shift, with the result that it will be turned inaccurately and, perhaps, cause the tools to break. The ordinary solid tailstock center has a limited usefulness in intensive turning operations. A copious supply of cooling compound is also essential for the satisfactory accomplishment of such operations, and Fig. 2 shows to what extent coolant is furnished in practice.

In the finish-turning operation illustrated in Fig. 8, the tooling is obviously determined by the finished dimensions of the work. Much higher speeds and finer feeds are used than in the roughing operation, and the result is an accurate and well finished piece that is produced in the same time as that required for rough-turning. The tools in the rear tool-holder produce grooves on the shank, and finish-turn, bevel, and neck the small end. On this job one man operates two machines, and the production ranges from twenty-five to thirty completely finished pieces per hour.

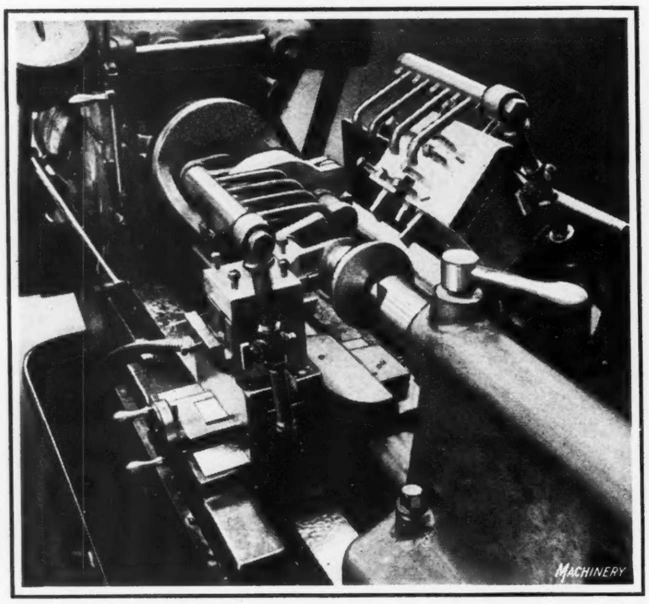


Fig. 12. Crankshaft End Bearings being machined with the Part supported by a Spindle Fixture

The part next goes to a drilling machine to have a long central hole drilled, although in some cases this operation is left until after it has been ground and gear teeth cut on one surface, as this provides a better means of holding. The final lathe operation then consists of finishing the large end on both the inside and the outside. For this purpose, the work goes to a second double-spindle production lathe equipped with the tooling shown in Fig. 9. The tools shown in positions 1A and 1B finish-bore the bearing seat, finish-turn the outside diameter of the gear and clutch portions, and finish-butt-face the end. A tool for recentering the bottom of the counterbore may also be provided, but this is not usually necessary, because the shank is finished true with the center and the work is held by the shank in an air-operated expansion collet.

Since the diameter of the shank may vary, the longitudinal position of each collet is not fixed and it is therefore necessary to stop the work against collars *C* which are fixed longitudinally. The holes in the shafts are reamed to size, ready for grinding, by the tools shown at positions 2A and 2B. The total time for this operation is but little more than would be required for producing one piece at a time.

Operations on Camshafts

The lathe work on camshafts can be performed on double-carriage Fay automatic lathes provided with tooling equipments as shown in the heading illustration and in Figs. 10 and 11. The particular forging shown in those illustrations comes to the machines with the end flange finished and drilled and the center bearing turned. It is necessary to have the center bearing turned previously, to provide bearing surface for the steadyrest. The flanged end is held in hardened and ground jaws in an air-operated chuck, the camshaft being driven by a dowel in one jaw engaging a bolt hole in the flange. There are two general methods of machining and hardening to obtain hardened cam and bearing surfaces and a soft body. One way is to machine the part completely and then carburize it, the surfaces to be left soft being copper-plated so that they will be protected during the carburizing process. The other method is to square the shoulders, rough-grind the cams and bearings, carburize the part, turn the body and other surfaces to be left soft, and then harden. In this way, the carbon is removed from the surfaces which have been turned, and consequently they will be left soft in the hardening process.

Fig. 10 shows the tool set-up used in squaring the shoulders, both the front and rear tool-holders being fed straight in. The camshaft is complicated by a pump cam located between the second and third valve cams from the right end. There is danger on a wide forming cut that a slender shaft will catch on the tools, ride up on them, and spring off the centers. For this reason, the cuts taken on both sides of the pump cam are divided into three chips by using alternate double and single tools at the front and rear of the work as shown. This arrangement tends to balance the stresses and makes heavier cuts possible on slender work of this sort. Fig. 11 shows the tooling equipment for the turning operation, the cuts being again balanced between the front and rear tool-holders. The rear tools are fed to the work at about the center of the space between the cams until they are cutting to depth, after which they are fed toward the tailstock. The operation of the front tools is similar except that they are fed toward the headstock. This permits the cuts to be overlapped somewhat so that surfaces of different lengths may be turned with one length of feed. It is also possible, as shown at the extreme right, to turn an extra long surface with two tools.

The heading illustration shows a machine set up for a job very similar to that shown in Fig. 10, and the production with one man running two machines is twenty-five camshafts per hour. The automatic feature of the machine is important in taking these short multiple cuts, as it saves the physical and nervous strength of an operator. All machine movements are automatic, with the exception of the opening and closing of the chuck and the changing of work. Six-cylinder camshafts are handled in a similar manner, except that, owing to their greater slenderness, it is often

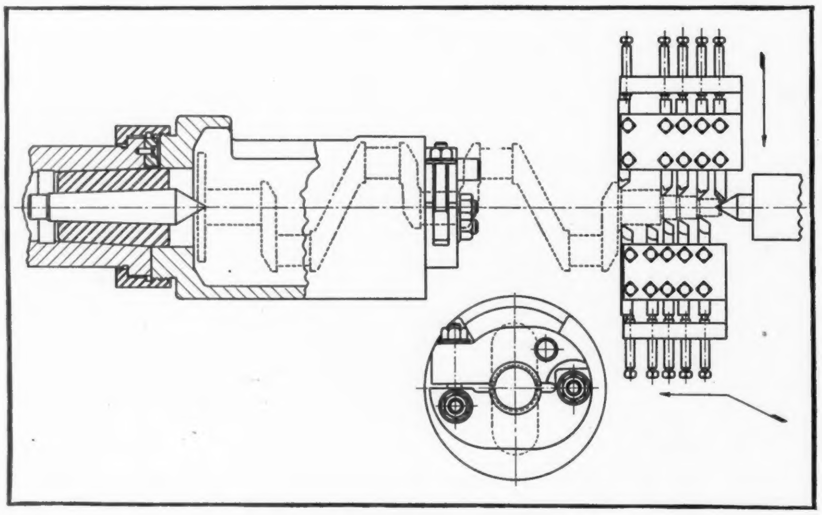


Fig. 13. Tool Set-up in which the Spindle Fixture used in Fig. 12 is also employed

necessary to divide the cuts into three operations and use fewer tools in each. It is important in shaft work to have all shoulders squared in one setting if possible, because this gives greater accuracy than when the work is transferred to another machine and, perhaps, turned end for end. It cannot be expected, of course, that the design of an automobile engine can be based on machining problems alone, but if it so happens that a designer can use a camshaft having the turned portions of approximately equal length and no form cut more than ½ inch in width, tooling problems will be considerably decreased.

Finishing Crankshaft End Bearings

Machining the end bearings of crankshafts bears a general resemblance to camshaft work, although it is simpler and heavier. An example is shown in Fig. 12; this is an ordinary three-bearing, four-cylinder crankshaft. The main bearing is supported in a clamp bushing mounted in a spindle fixture. The latter will be more clearly seen in Fig. 13. Of especial interest are the form of the spindle end and the means used for holding the overhanging fixture. The production obtained on these machines is twenty crankshafts per hour, with both ends machined, and one man running two machines.

* * *

IMPROVEMENTS IN LOCOMOTIVE DESIGN

By ARTHUR GORE

The railroad companies who are anxious to put their roads back on a paying basis realize the necessity for reducing their operating expenses as well as increasing efficiency in every way possible. The motive power is, of course, one of the principal sources of expense in the operation of a railroad. The price of coal has increased enormously in recent years, and it is therefore of the greatest importance that every available means be employed to cut down the fuel consumption.

The locomotive in its present form is very wasteful. Steam is used at the boiler pressure for 75 per cent of the piston stroke before being expanded, and is exhausted into the air when still at a high pressure. This practice is anything but economical, and some means of utilizing this exhaust steam for tractive purposes should be adopted. It may be said that it is general practice to shovel coal into the furnace by the ton, and allow a large percentage to be ejected at the stack in the form of smoke and cinders. A large proportion of the heat energy of the coal—sometimes as much as 50 per cent of the total amount—therefore does no useful work.

Coke as a Fuel

The purpose of this article is to suggest improvements in the design and method of operating locomotives that will not necessitate material alterations or changes, yet that will be of such a nature as to result in substantial reductions in the operating expense. With this idea in mind, attention is directed to the successful operation of by-product coke ovens, which has made it possible to solve many of the problems that at one time seemed unsurmountable. It is proposed that this vast industry and especially its new developments be studied carefully with a view to utilizing some of its products as locomotive fuel.

Motorizing Locomotive Tender

It is proposed that the present tender of the locomotive be changed to permit of the installation of a high-pressure steam turbine between the frames. This turbine would be coupled to the axle by suitable gearing. The exhaust from the main cylinders would drive the turbine, and the exhaust from the turbine would be directed to the uptake. Coke and tar would be the fuels utilized in the furnace, the latter being fed through suitable injectors by steam, and the former fed by hand in the usual way. A good draft and a very incandescent fire should result from this combination of fuels. Tar has been used as a fuel for a number of years by some of the European railroads and has given excellent results.

In the case under consideration, tar, being one of the chief by-products of the coke oven, would be a cheap fuel. It has given great satisfaction in steel furnaces in conjunction with coke oven gas. The use of the locomotive tender as a motor is not a new idea, but the introduction of a steam turbine seems original in locomotive practice, although there is no mechanical reason why it will not adapt itself to that service, and at present this plan is being tried out in Europe by one of the leading locomotive builders. Undoubtedly, the most economical method of using coal as a fuel is to extract its constituents in the by-product coke oven and use them separately, and not shovel it into the furnace as at present in an indiscriminate mass. It is understood that the present average consumption of coal on our railroads is about sixty pounds per mile.

Turbine-driven Tender

Objections will doubtless be raised against the use of turbines for railway work, but it should be remembered that some of the largest and fastest ships are driven by reciprocating engines which exhaust into low-pressure turbines. However, objections will undoubtedly be made against any radical change in the present design of locomotives. It may be recalled that when Parson's turbine was first introduced, it was rejected by the leading engineers of the day.

The Mallet type of articulated locomotive, while in use for many years in Europe, did not find favor in this country until the railroad managers were forced to find a means of hauling the ever-increasing train loads without injury to bridges and road-beds. The tender has always been a cumbersome element to deal with, and if it can be utilized for hauling or tractive purposes much expense may be eliminated. It would not be necessary to change the present design of tender materially in the improved type. A simple engine with two high-pressure cylinders equipped with the Walschaerts valve gear could also be employed. The boiler could, in the writer's opinion, be shortened without decreasing the efficiency of the heating surface.

* * *

SPECIAL LIBRARIES IN MANUFACTURING PLANTS

The increasing importance to the industrial executive of accurate facts and information is illustrated by the rapid growth of industrial research libraries, with trained library experts in charge. As the result of a survey recently made by the Special Libraries Association, it was found that there are over 1300 special libraries throughout the country, and of this number more than 200 are directly concerned with industrial and manufacturing subjects. Special libraries have demonstrated their value in all the more important lines of manufacture. Such collections are maintained by companies producing metal products, electrical supplies, explosives, rubber, oil, paper, textiles, shoes, office appliances, firearms, etc. While industrial libraries are maintained primarily to aid the executive officers of the concern, they have frequently rendered valuable service in the education of company employes. In some cases the central library has extended its facilities to factory branches in various parts of the country by the establishment of branch libraries and information departments. Many of the industrial libraries have interesting special features. In several instances bibliographical or news bulletins are issued. During six months, 1790 reference questions were answered by one library. The complete findings of the Special Libraries Association's survey have recently been published in the form of a "Special Libraries Directory," edited by Dorsey W. Hyde, Jr., president of the association, 3363 Sixteenth St., Washington, D. C.

How To Reduce Production Costs ?

Combination Dies for Finishing Parts in One Stroke

By J. BINGHAM, President, Bingham Stamping & Tool Co., Toledo, Ohio

COSTS may be reduced and the production of various styles of drawn covers for such articles as tobacco cans, etc., may be readily accomplished in one power-press operation, provided the machine is equipped with some type of combination die. Fig. 1 illustrates a combination blanking and drawing die employed in the manufacture of the cover shown at the bottom of the illustration, this part being made from 0.011-inch sheet iron, commonly called "tin." In the operation of this die, a strip of metal is placed on die ring *A*, the top of draw-ring *B* being raised to the same level as the cutting edge of ring *A* through the action of the rubber buffer which actuates the block upon which pins *C* rest.

When the punch descends, the face of ring *D* is advanced ahead of the face of section *F* by coil springs placed between the ring and section *E*, and cuts the blank to a diameter of 5⅝ inches as it enters die ring *A*. The draw-ring then holds the blank firmly against the face of ring *D* and retards the movement of the latter, so that the coil springs are compressed and the relation between the faces of ring *D* and section *F* is changed, permitting section *F* to draw the part to the desired shape on ring *G*. The operation is completed when ring *D* and section *E* come into contact. The draw-ring ejects the work from the die when the punch ascends while ring *D* forces it from the punch.

Although this job would be a difficult one if an ordinary solid punch were employed, it was accomplished satisfactorily by means of the sectional punch. The coil springs are made of 1/32- by 3/32-inch flat wire and are about ½ inch in diameter. Attention is called to the provision of a block *H* in a counterbored hole in the bolster plate. This arrangement eliminates the necessity of machining holes through the bolster plate to accommodate draw-ring pins, because they can be located in the special block. Therefore, the bolster plate does not become ruined after a number of dies on which the diameters of the draw-rings vary are mounted on the machine, because a suitable block may be provided for each die. The only holes required on the bolster plate are those for bolting the die-shoe to it. This construction has been used for years with complete satisfaction.

Drawing a Canister Top by the Inverted Method

The die shown in Fig. 2, which is used for producing canister tops, cuts the blank and then performs two distinct drawing operations, the part being first drawn as shown at *A* and then as shown at *B*. This method is known as "inverted drawing." The material used for the part is 0.028-inch sheet iron. Normally, the top of draw-ring *C* is held in the same plane as the top of die-ring *D*, by a stud and rubber buffer arrangement which functions similarly to that on the preceding die. The blank is cut to a diameter of 6½ inches by ring *E* of the punch as the latter enters the opening in ring *D*, after which the draw-ring holds the blank firmly against ring *E* as this member continues to descend, and draws the part on ring *F* of the die to the shape shown at *A*.

As this step is concluded, pad *G* and the spring-actuated ring *H* come in contact with the work and cause it to be drawn to the shape illustrated at *B*, during which time ring *H* is retarded so that the springs placed above it (not shown in the illustration), become compressed. By this construction ring *H* functions in the same manner as a draw-ring. Upon the return stroke of the punch, the springs

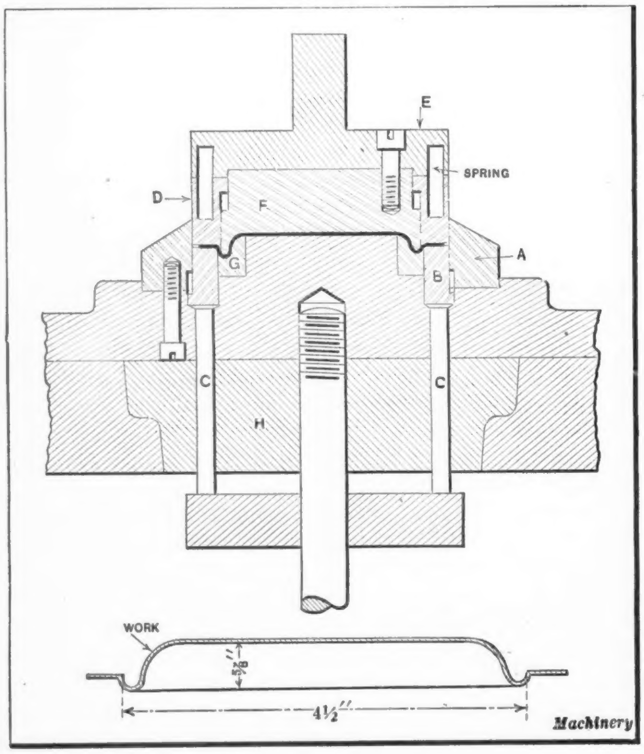


Fig. 1. Making a Tobacco Can Cover in One Operation by Means of a Combination Blanking and Drawing Die

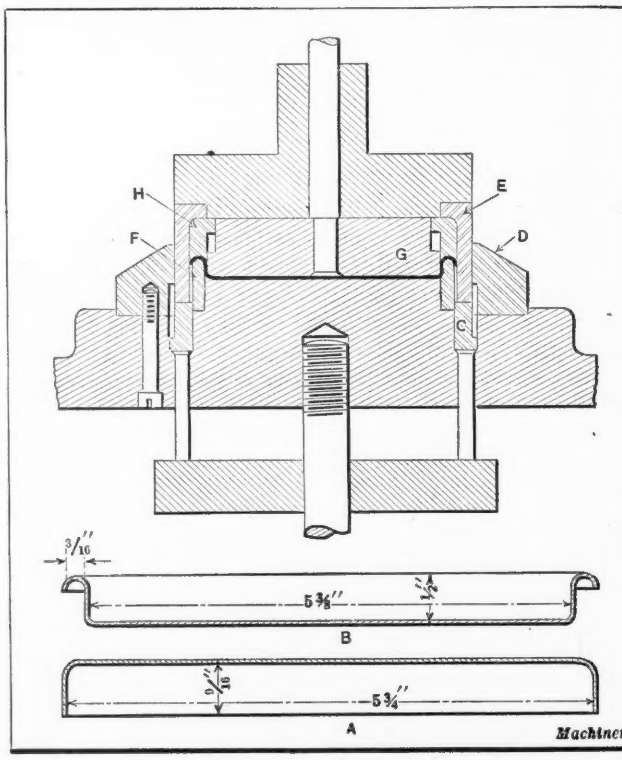


Fig. 2. Another Combination Die which produces a Canister Cover by the Inverted Method of drawing

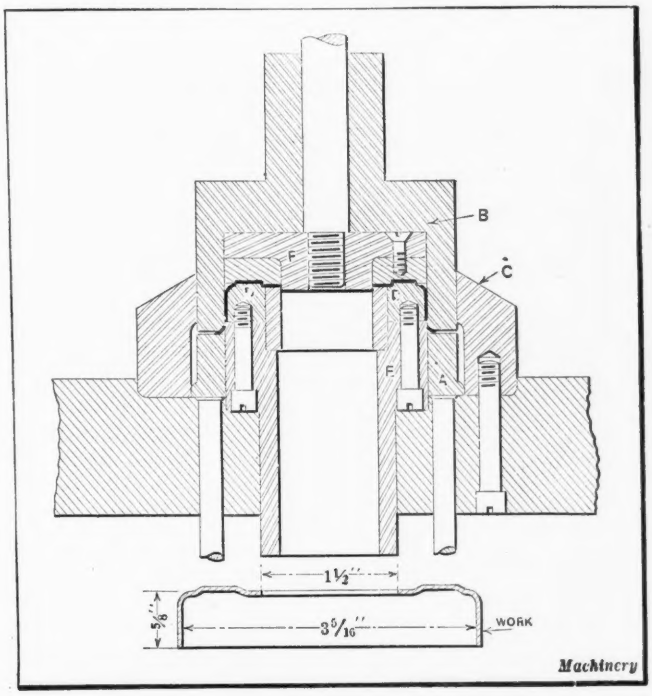


Fig. 3. Performing Blanking, Drawing, Trimming and Punching Operations in a Single Stroke of the Press

expand and cause ring H to eject the work from the punch. Ring E is secured to the punch-holder by means of machine screws. As indicated by the view of the work at A, the face of ring E projects 9/16 inch plus the thickness of the metal beyond pad G.

Die which Blanks, Draws, Punches, and Trims

Another interesting combination die is illustrated in Fig. 3. This die blanks, draws, punches the hole, and trims the lower edge of the part shown beneath the die, the material being 0.035-inch cold-rolled steel. Draw-ring A of this die serves in the same capacity as those on the dies previously discussed. The blank is cut as punch B enters ring C, and is drawn upon ring D as the punch continues to descend. During the lower portion of this stroke the bottom edge of the work is sheared off as the punch face passes the upper edge of die-sleeve E due to the outside diameter of the latter being the same as the internal diameter of the punch. As soon as this trimming step has been completed, section F comes in contact with the work and cuts the hole as the stroke of the ram is concluded.

Section F enters the die only a slight amount approximately equal to the thickness of the metal. If the section entered the hole much further, a perfectly round hole would not be obtained. The scrap from the operation falls through the die and an opening in the rubber buffer, which in this case is supported by two studs. Although the trimming step really consists of "pinching" off the metal rather than cutting it, the method has been satisfactory on metal up to 0.065 inch in thickness and is probably practical up to a thickness of 3/32 inch.

* * *

STANDARD PATTERN PRACTICE

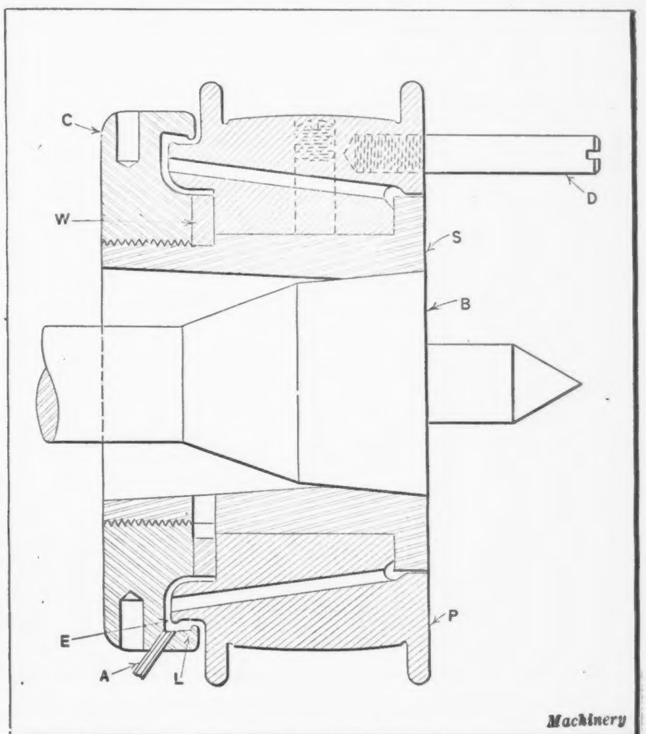
Last year the American Society for Testing Materials requested the American Foundrymen's Association to sponsor an effort to standardize patterns, core-boxes, etc. A general committee was organized, consisting of two members from each of the following organizations: American Society for Testing Materials, Institute of Metals Division of the American Institute of Mining Engineers, Steel Founders' Society, American Malleable Castings Association, and the National Association of Pattern Manufacturers. Vaughan Reid of the City Pattern Works, Detroit, Mich., is chairman of the committee, and any suggestions on this subject will be welcome.

DEAD CENTER DRIVE FOR BENCH LATHE

The dead center drive shown in the accompanying illustration was designed to fill the need for an attachment not ordinarily included in the equipment of a bench lathe. Referring to the illustration, S is a hardened and ground sleeve made to fit over the tapered end of the hollow spindle of the lathe. This sleeve serves as a bearing for a light weight pulley P which may be made of cast iron but preferably of aluminum. The pulley is held securely between the flange on the sleeve and a hardened steel washer W which is tightened against a shoulder on the sleeve by the collar C.

In order to prevent oil from being thrown from the rims of the pulley, an oil-groove is cut into the corner which fits over the flange, and a series of holes drilled from the bottom of this groove, on an angle, so that centrifugal force will cause the oil to flow toward the collar C. The collar C is grooved in such a manner that a small lip L having a slight taper catches all the excess oil and allows it to drain off through a pipe A inserted at the bottom of the collar. The projection on the pulley, as shown in the illustration, enters the groove in the collar, and the holes through which the oil passes in the pulley break through in the projection so that oil which comes through them must be thrown from the lip E into the groove in the collar. Oil coming from the other end of the bearing is carried around the inner contour of the pulley projection and is thrown off lip E and caught by lip L in the same way.

The plug B takes the place of the draw-back collet and is threaded to suit the draw-back sleeve of the regular machine. The end of the plug is tapered to suit the taper in the sleeve. When the sleeve, pully, washer and collar assembly is placed over the end of the lathe spindle, the plug B is inserted and screwed into the draw-back sleeve. When the draw-back handwheel is turned up tight, the plug is drawn in so that the sleeve is firmly held on the spindle. The addition of a driving pin D in the pulley completes the attachment. Pin D should be slotted so that a screwdriver can be used to tighten it in the tapped hole in the pulley. Of course, an oil-hole is provided in the pulley which is plugged with a headless screw. The lathe center furnished with the machine may be used if desired, in which case it is driven into a tapered hole in the plug B. It is necessary to provide an extra pulley on the countershaft for driving the attachment pulley. B. S.



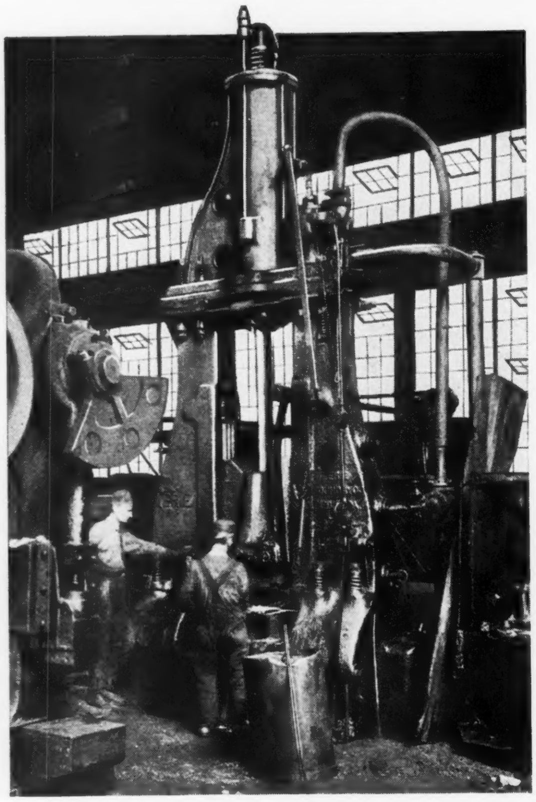
Dead Center Drive for Bench Lathe

Modern Drop-forging Practice

Trimming the Forgings—Forging Heats—Typical Examples of Drop-forging Work
Second of Two Articles

By FRED R. DANIELS

THE previous article on this subject published in November MACHINERY dealt with comparative characteristics of drop-forgings and castings, application, steels used for drop-forgings, and general methods of making drop-forgings. The present article takes up the trimming of the forgings and correct forging heats, and gives typical examples of drop-forging work.



Trimming the Forgings

After each operation has been performed on the drop-hammer, the flash, or surplus metal, must be trimmed from the forging, either while it is still hot or after it is cold. The percentage of metal lost by the trimming operation is necessarily great; the loss may be from 33 to 50 per cent, and is relatively greater on small work than on large forgings.

It seems to be best practice to use the cold-trimming process for small work. If a heavy geared press is used and the trimming dies are properly proportioned, rather large forgings can be trimmed cold, provided the flash is not excessively thick. On ordinary work where the design is not intricate, the flash should not be thicker than 1/16 inch, for cold-trimming, but on unusually large or intricate work the flash may be as thick as 3/16 or even ¼ inch and still be cold-trimmed. A case where the formation of a thick flash seems unavoidable is the motor truck towing hook, the dies for which were illustrated in Fig. 9 of the article "Design and Making of Drop-forging Dies" published in September MACHINERY. The maintenance of a thin flash is, of course, the desirable condition.

Forgings which are to be cold-trimmed should first be pickled in a weak solution of sulphuric acid to remove the oxide scale. This practice will prolong the life of the cutting edge of the trimming dies. Drop-forgings, having a carbon content of 0.40 per cent or more should also be annealed before being trimmed.

For large work, the usual practice is to trim the forgings while hot. In fact, it is impossible to perform a cold-trimming operation on such parts as crankshafts. Whether the work should be trimmed hot or cold depends upon the steel used, the sizes of forgings produced, and the equipment available in the hammer shop. The question of cost is also a factor. Hot-trimming is more expensive than cold-trimming, because the drop-forger receives a higher rate of pay than the power press operator; an unskilled man, or even a boy, can operate a power press. Consequently, where it is practicable to make the trimming operation a separate one and trim cold, this should be done.

One reason that hot-trimming should not be done on comparatively small work, if it is possible to avoid it, is that the hammer man consumes so much time in transferring the forging to the hot-trimming dies and operating the press that the fires must be slowed down, and the entire cycle of operations is correspondingly affected. After the forgings have been hot-trimmed, they are usually placed in the finishing die again, and restruck to correct any distortions that may have been produced in the process of hot-trimming, and to remove irregularities at the parting line. In addition to this extra handling, it is necessary to crop off the sprue by means of which the forging is handled with the tongs. This may be done in a separate operation, after the forging is cold or it may be removed in the hot-trimming operation; in this case the forging is not restruck.

Hot-trimming dies will give much longer service, however, than cold-trimming dies. If the tools are properly hardened and drawn, they will last almost indefinitely, even though the steel from which they are made has 0.10 per cent less carbon content than that ordinarily used for cold trimmers. The design of the work to be trimmed and the composition of the steel from which the forging is made, rather than its size, affect the length of service of a cold-trimming die. On comparatively plain designs it is frequently possible to trim 20,000 parts without regrinding the cold trimming dies.

The process of drop-forging has been developed to a point where thousands of pieces are practically completed under the drop-hammer and require little or no further machining operations. As a cost-reducing method, drop-forging ranks high among metal-working processes. In the drop-forging plant itself, costs may be reduced by applying certain principles and methods making for economy—by selecting steel of the right quality, and by keeping dies and stock in such a manner that they are readily accessible and the required die and the right size and kind of steel may be easily located. Drop-forgings, when used in quantity, can sometimes be made as cheaply as castings, and are superior in strength. Actual costs are then reduced by employing them, because of the improved quality obtained at an equal price. Furthermore, a saving is usually made in the cost of machining, due to the fact that a drop-forging generally requires less finishing than a casting.

Forging Heat—Life of Dies

The determination of the proper heat to use in a forge furnace is under the general supervision of the forge foreman and is governed entirely by his experience. The pieces are placed on the hearth of the furnace by the furnace man,

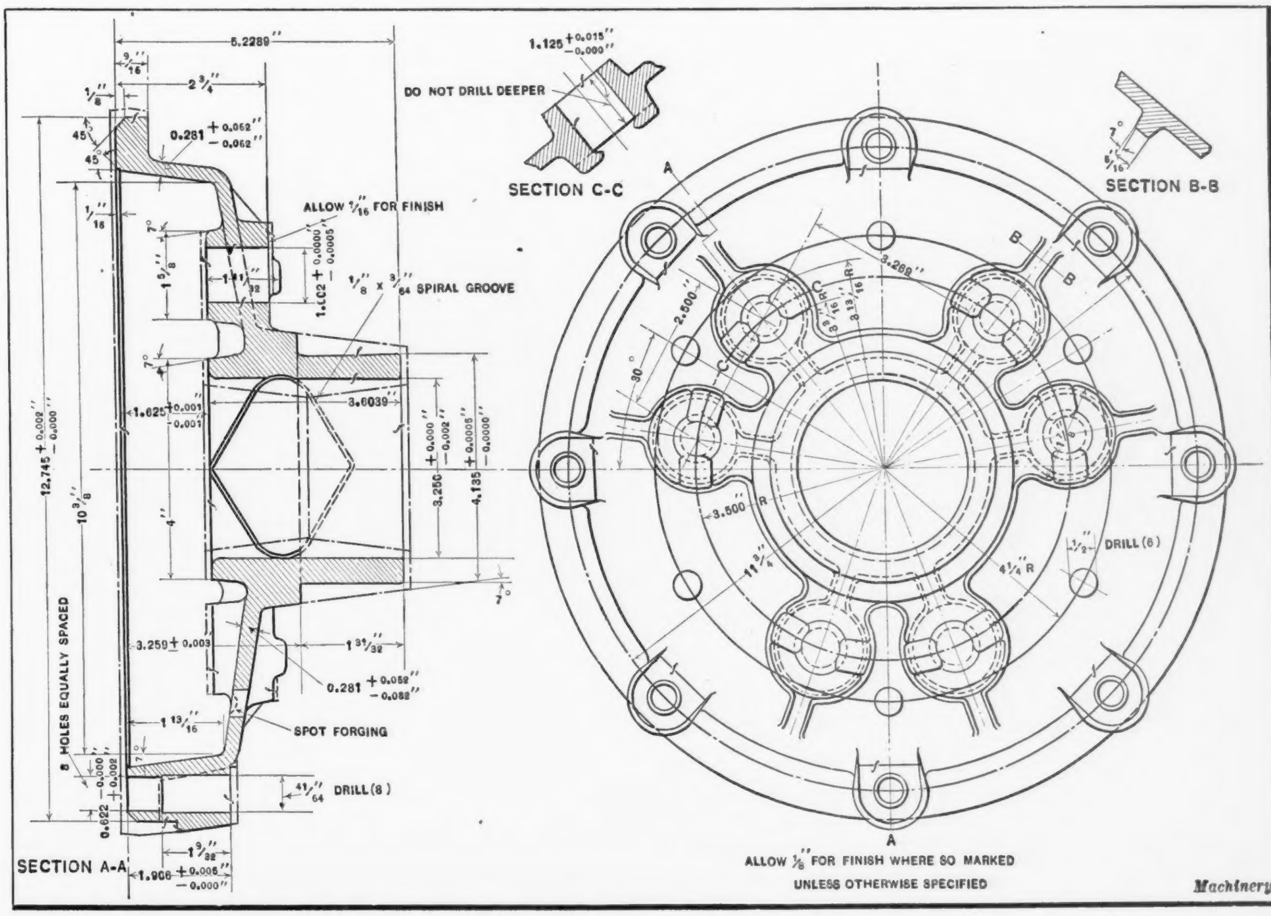


Fig. 1. Differential Gear-case for Motor Truck, which is produced by drop-forging

and arranged in a row with the tong-end protruding, in such order that they may be conveniently handled. If the forgings are made from bars, these are arranged on the furnace hearth in such a way that the one nearest to the hammer will always be the one to be withdrawn first and handed to the forger. After the forging has been made, the hammer man passes the remainder of the bar back to the furnace man, who places it at the head of the row and passes the next one on the opposite end to the hammer man. In this way, each bar will be heated equally, and there will be slight chance of the furnace man becoming confused and drawing a bar from the furnace before it has reached the proper forging temperature. On large work, which is hot-trimmed, three or more men constitute a gang instead of the two usually employed for handling small work, there being helpers in addition to the hammer man and furnace man. If the forgings are made from blanks cut to a predetermined size, there will not be room on the hearth for more than three, or possibly four of these at a time. These large blanks may be conveniently arranged to have the blank which is ready to be drawn nearest the hammer the same as in handling bars, or they may be reversed if the furnace man finds this to be handier.

The piece to be forged should be heated evenly throughout. There should be enough bars or blanks placed in the furnace at a time so that they will become thoroughly soaked with the heat before being withdrawn. If opposite ends of a large forging blank are unequally heated, the strength of the drop-forging is greatly lessened, and if this is frequently done, the dies will wear unevenly which will result not only in an inferior product, but may also lead to the hammer being seriously damaged. During the process of forging a quantity of parts, the impressions of the dies should be swabbed from time to time with crude oil to prevent the work from sticking in the impression.

If the forgings are of comparatively plain design and have no high or irregular projections, it is frequently possible to realize a production of 15,000 drop-forgings before it becomes necessary to resink the impressions. If the forgings are of rather intricate design, this quantity will probably not exceed 5000 forgings per impression. This data applies to dies having faces not greater than 14 inches square. Production on dies larger in face area than this, but of the same classification, will, of course, be proportionately less.

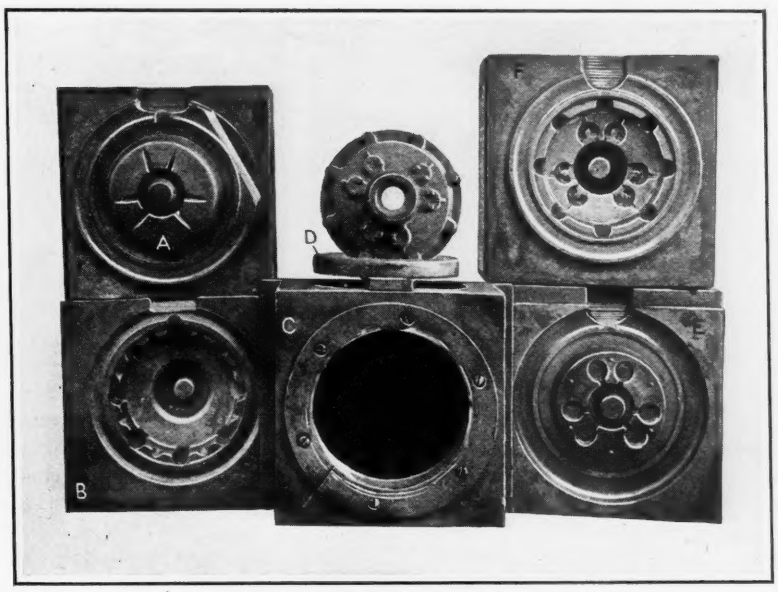


Fig. 2. Dies for producing the Differential Gear-case shown in Fig. 1

The life of drop-forging dies can be prolonged by working them while heated to a temperature between the hardening temperature of the die steel and the atmospheric temperature. Various methods may be used

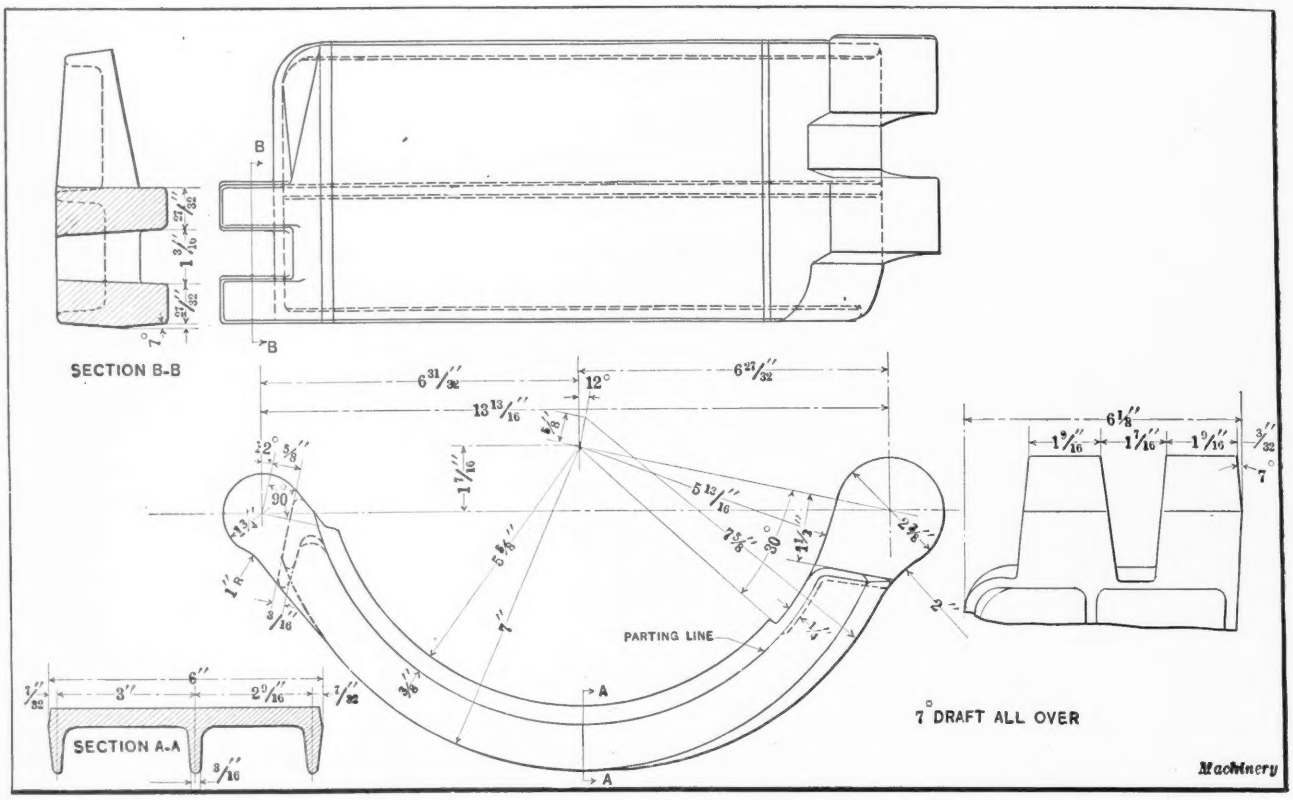


Fig. 3. Emergency Brake-shoe drop-forged from Low-carbon Steel

for heating the dies, one of which is to apply a jacket to the outside of the die-block, which is tightly packed with a suitable layer of infusible earth or fine molding sand, the packing being heated by the most convenient means available. For this purpose gas burners or an electric current may readily be utilized. Molten baths of lead or lead and tin alloy may be used if the die does not need to be heated over 600 degrees F., or use may be made of an oil bath if that is more convenient. For controlling the heat of the die-block, a heat-indicating instrument is set either into a recess in the block, into the packing, or in the bath.

For heating carbon steel blocks, the recommended temperatures vary between 300 and 1100 degrees F., but for certain grades of alloy steels, a higher temperature may be necessary, provided this is well below the hardening temperature. The heating temperature depends, of course, upon the composition of the die steel which can be determined from the manufacturers.

Straight carbon steels having a hardening temperature between 1400 and 1475 degrees F. will be given a high degree of resistance to wear if heated from 400 to 500 degrees F. while in use; and the lighter the falling weight of the drop-hammer (or the more easily the steel can be forged) the nearer can the lower limit—that is, 400 degrees F.—be approached. Dies made from alloy steels, such as chrome-nickel, carbon-chromium, chrome-vanadium, cobalt-chromium, tungsten or molybdenum require a considerably higher temperature than carbon steels. Heavy forging and trimming dies made of tungsten high-speed steel require a temperature of about 100 degrees F. which in some cases practically doubles the life of the dies, and for alloy die steels containing no tungsten a working temperature of about 850 degrees F. should be used.

Examples Illustrating Drop-forging Procedure

The automobile towing hook shown in Fig. 8 of the article "Design and Making of Drop-forging Dies," previously referred to, is made from a piece of 4- by 1¼-inch steel, 8 inches long, in two forging operations followed by a bending operation in an upsetter. The steel contains from 0.30 to 0.40 per cent carbon, and from 0.50 to 0.80 per cent manganese. On this job the waste of stock is great, the entire area between the arms being webbed before the trimming operation, in addition to carrying a heavy flash. The trimming operation could be performed cold, although the actual practice in manufacturing this hook is to trim it hot. This saves transporting the work to the cold-trimming department and back again to the upsetter for bending, which, of course, cannot be done until after the flash has been removed.

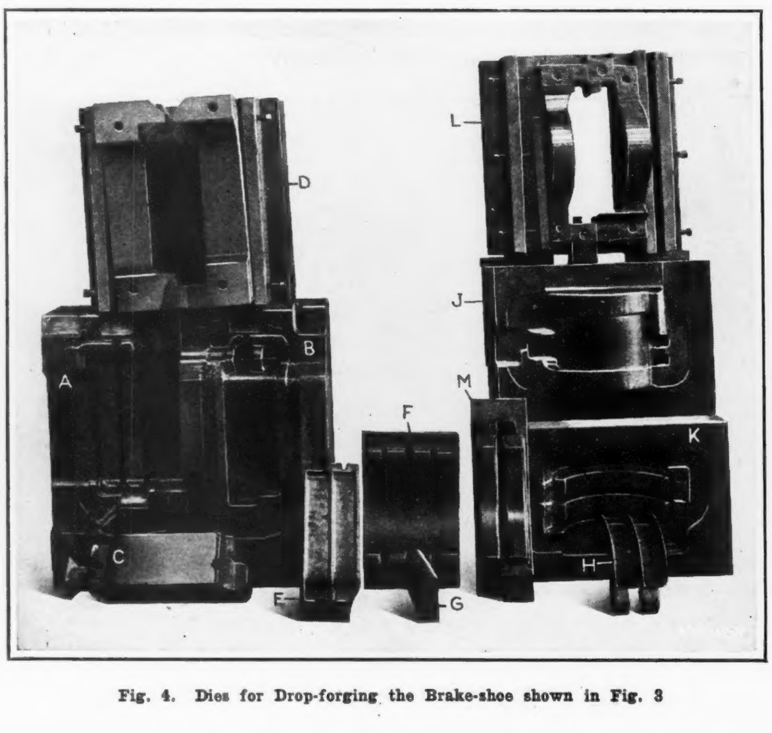


Fig. 4. Dies for Drop-forging the Brake-shoe shown in Fig. 3

It is possible to produce parts such as wide yokes by drop-forging. In such work the die impressions are made so that the two arms of the yoke are parallel

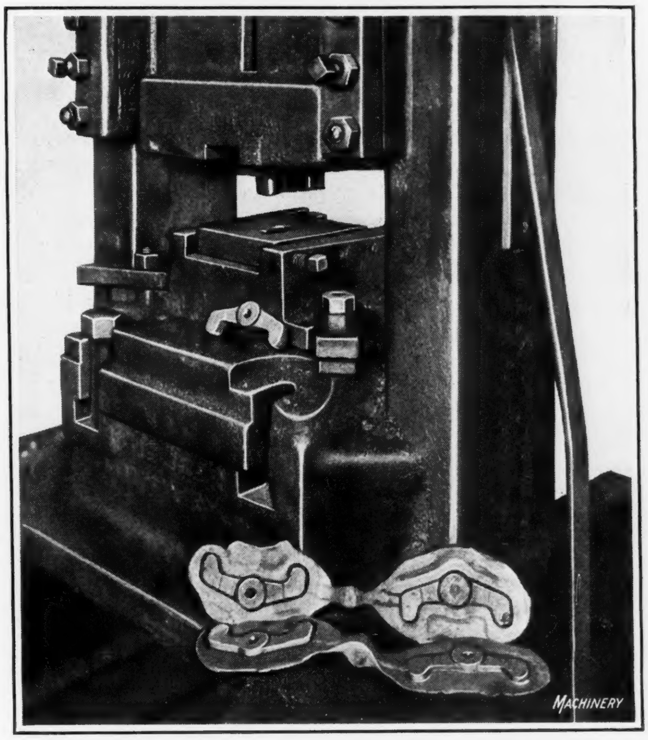


Fig. 5. Power Press equipped with Cold-trimming Dies

and close together; after the forging has been made from this impression, the arms are spread to the proper width, and if necessary, restruck in finishing dies. This permits a much smaller die-block to be used, and also enables the blank from which the yoke is to be forged to be of smaller size, which results in a considerable saving of material. This, in fact, is common forging practice, where the pieces are of such a nature that they can be drop-forged in one form and subsequently shaped to another by bending.

Another excellent example of drop-forging practice is that of the differential gear-case for a motor truck shown in Fig. 1. This illustration shows the rough forging on which there is 1/8 inch allowance for machining, wherever finish is required. The gear-case is made from a piece of open-hearth steel, 0.20 to 0.30 per cent carbon, high in manganese, the dimensions of the blank being 1 3/4 inches thick by 11 inches square. This piece, with its many bosses and projecting hub, shows the possibilities of the drop-forging process for producing parts that are of intricate shape.

Two operations are required to complete the job, exclusive of trimming. It is first blocked or broken down on a 5000-pound steam drop-hammer, and then after being reheated, is finish-forged in a 6000-pound steam drop-hammer. Both trimming operations are performed hot. The entire collection of dies, including trimmers and punches, is shown in Fig. 2. *A* and *B* are the upper and lower break-down dies, respectively, and *E* and *F* are the finishing dies. The trimming die is shown at *C*, and the punch (on which will be seen the finished forging) at *D*. The finishing dies are plug dies, designed to produce the hole in the hub. By employing this construction advantage is taken of the tendency for the hot metal to shoot up, in order to form the hub.

Still another example of what can be accomplished by drop-forging is shown in Fig. 3. This is a motor truck emergency brake-shoe, weighing 26 pounds. The forging is made from low-carbon open-hearth steel, and three operations are required to produce it. The blank from which it is made is 5 inches wide, 2 inches thick, and 15 inches long. It is first blanked, and then trimmed hot and bent, all these operations being done without reheating. The bending die is attached to the outside of the frame of the hot-trimming press, where the shear blades are ordinarily attached. The bending operation can then be done without much loss of time or heat. The forging is next reheated and finished in a double-impression die, after which the flash is trimmed hot. The blanking operation is done on a 3000-pound steam drop-hammer; the finishing on a 5000-pound steam drop-hammer; and the bending and trimming on a heavy back-geared press.

In Fig. 4 is shown the set of dies with which these machines are equipped to produce the brake-shoe. It will be noticed that the breakdown dies *A* and *B* are of comparatively plain design. The first-operation trimming die is shown at *D* and the punch at *C*. The drop-forging, as it comes from the first-operation trimmer, is shown at *E*, although the sprue has been knocked off the piece shown. The bending die *F* is a plain cradle member, and the bending punch *G* simply bears on the work at the center as it lies on the die *F*, contacting on the rounded end. The dies *J* and *K* produce the finished forging, which when trimmed by die *L* and punch *M* has the appearance shown at *H*.

Examples of Trimming Work

Examples of cold- and hot-trimming operations are shown in Figs. 5 and 6, respectively. The press shown in Fig. 5 is equipped with dies of the ordinary power-press type such as used for punching operations, although this type of die is not always used for cold-trimming. The function of the punch is simply to push the cold forging through the die opening, as in hot trimming. The small levers which are to be trimmed are made from open-hearth steel of low-carbon content and are shown in detail in Fig. 7. The forgings are produced in double-impression finishing dies, but the trimming must necessarily be performed singly, as will be understood by an inspection of the punch, the trimmed forging shown resting on the press, and the untrimmed work. The untrimmed forgings are likely to become bent at the gate, which makes it difficult to trim both parts simultaneously.

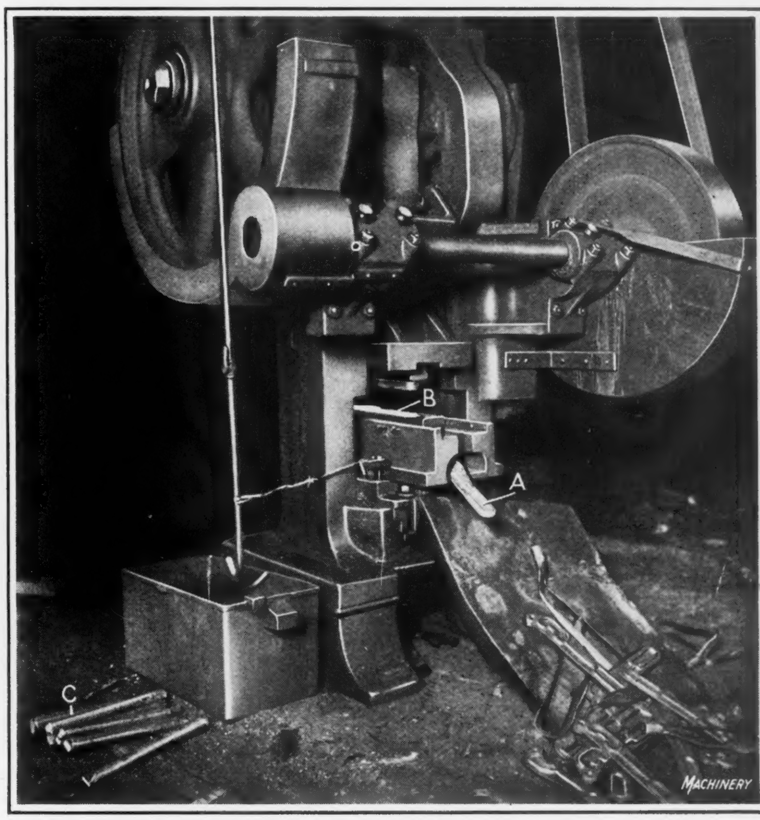


Fig. 6. Geared Press engaged in a Hot-trimming Operation

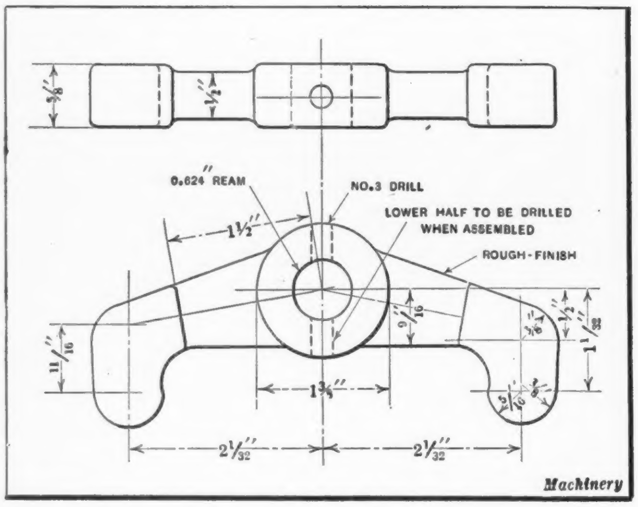


Fig. 7. Drop-forging trimmed with the Equipment shown in Fig. 5

In Fig. 6, a hot-trimming operation is shown in process and the work being trimmed is a small carbon-steel forging. The illustration shows the hot drop-forging *A*, with the flash removed, after being pressed through the die opening, and an untrimmed forging *B* resting in the die opening. There are also a number of trimmed pieces shown lying on the floor. This drop-forging is a latch cylinder locking link for railroad switch work, and is made from open hearth steel, 0.15 to 0.20 per cent carbon. The size of the blank is 1⅝ inches in diameter, and 18 inches long. A number of these blanks, which are cropped from regular bar stock, are shown lying on the floor at *C*, preparatory to being heated.

Machinery is indebted to the Union Switch & Signal Co., Swissvale, Pa., and to J. H. Williams & Co., Brooklyn, N. Y., for much of the information contained in this article. The concluding installment of this series of articles will describe modern drop-forge plant heat-treating equipment, heat-treating processes, and types of furnaces and fuels suitable for this work.

* * *

DELAMATER-ERICSSON MEMORIAL TABLETS

On March 9, 1922, which will be the sixtieth anniversary of the battle of the *Monitor* and *Merrimac* at Hampton Roads, Va., which demonstrated the merits of the turret battleship, invented and designed by Captain John Ericsson, tablets will be unveiled at four different places in New York City to commemorate the work of Cornelius DeLamater and Captain John Ericsson, who for fifty years—from 1839 to 1889—were pioneers in developing the naval, marine, and industrial interests of this country, and who at the time of the Civil War, without thought of personal reward, turned their mental and financial resources to account and applied their energy and experience to accomplishing what the Government had failed to do. One of the tablets will be erected where the Phoenix Foundry was located, at 260 West St., where the first iron boats in this country were built and where John Ericsson first introduced screw propellers for river and ocean steamers. A second tablet will be erected at the DeLamater Iron Works, at the foot of W. 13th St., where the first self-propelled torpedo, the first torpedo boat, the first submarine boat, and the engines for the original *Monitor* were built. A third tablet will be erected at the Continental Iron Works, Greenpoint, Brooklyn, where the hull of the original *Monitor* was built; and a fourth tablet will be placed at 36 Beach St., where Captain John Ericsson worked, lived, and died.

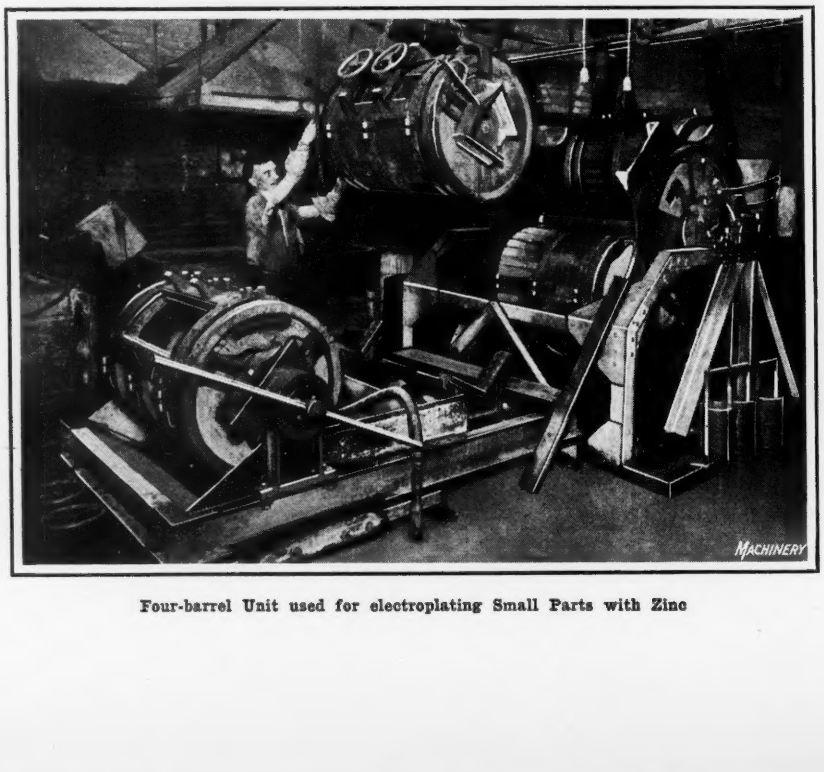
ZINC ELECTROPLATING UNIT

Confronted with the problem of increasing the output of zinc-plated parts used in electric controlling devices, the Cutler-Hammer Mfg. Co., Milwaukee, Wis., developed and patented the electroplating unit shown in the accompanying illustration. The apparatus consists mainly of a structural steel frame and a rotating member on this frame in which four wooden barrels are mounted. These barrels are filled with the zinc solution and the parts to be plated. They are stationary on their own axes, but, of course, revolve with their supporting member. The latter is driven by a 1-horsepower motor through two gear reductions, the first of which is a worm and worm-wheel, and the second a spur pinion and gear. The barrels are turned at the rate of three and one-half revolutions per minute. The electric current connections to the solution in the barrels are made by means of the V-shaped castings on their ends, these castings being copper-faced. The placing of a barrel into position in the carrier automatically makes the electrical connections.

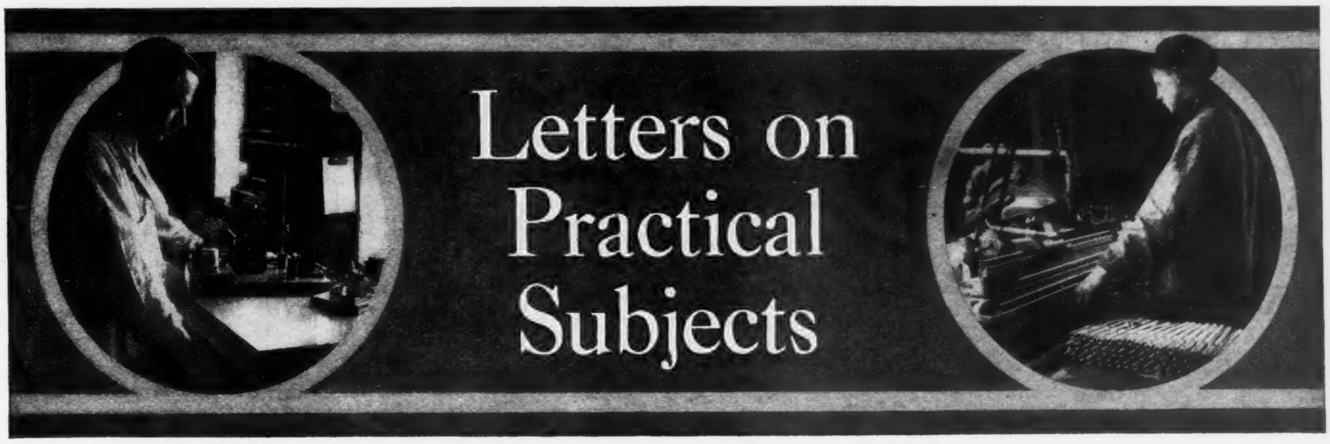
It has been found desirable not to load and unload the four barrels at one time, but rather to replace one, run the machine a certain period, replace another, and so on. An extra barrel is provided so that little time is lost in changing barrels, the change being effected in one and one-half minutes. Each barrel remains on the apparatus for forty minutes, and as there are four barrels, this requires the changing of a barrel every ten minutes. During the removal and replacement of a barrel the current is not cut off from the other barrels; therefore, the plating is continuous. When a barrel is removed, it is placed on supports over an open bin at the left of the unit, and then the barrel with the unplated parts, which has been resting on vees at the front end of the bin structure, is lifted into place. An air hoist is employed to facilitate the shifting of the barrels.

After the apparatus has again been started, the operator removes the cover from the barrel over the bin and then revolves this barrel about 180 degrees so as to permit its contents to drop into the bin. Screens at the bottom of the latter allow the solution to drain off, after which the parts are dumped into suitable receptacles. The drained solution is used over again. When the barrel is empty, it is placed on the vees, filled with unplated parts and the plating solution, and after the cover is replaced, it is ready to be mounted on the apparatus once more. Approximately 300 pounds of parts can be loaded into a barrel, and so an average production of 6 tons per nine-hour day is obtained. The barrels are about 30 inches long and 24 inches in diameter. They are made of oak timber, and are secured on the unit by hook bolts.

O. L. J.



Four-barrel Unit used for electroplating Small Parts with Zinc

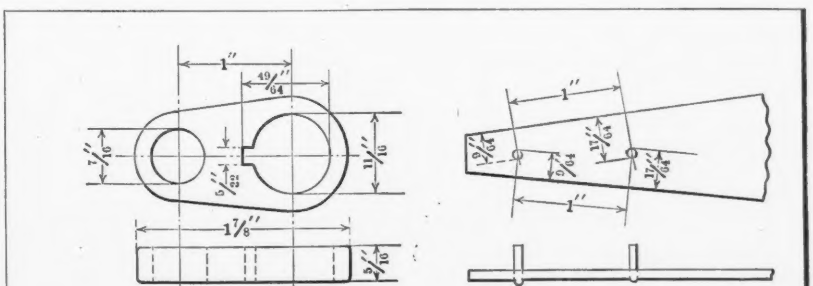


TEMPLET FOR LAYING OUT KEYWAYS

The accompanying illustration shows a templet that may be used advantageously for laying out keyways which must be symmetrical relative to a center line. A typical example of work on which a templet of this kind may be used is shown in the upper left-hand corner of the illustration. Ordinarily, in laying out the center line in tapered pieces such as this, considerable trouble is experienced, it being necessary to use plugs and resort to considerable calculation if a templet is not used. For accurate work, the outside of the part is seldom suitable to use as a locating surface.

The templet used for laying out the keyway in the work, and its method of application are shown in the lower part of the illustration. The templet is made from a strip of 1/16-inch sheet steel, in which two 1/16-inch pins are assembled. In laying out the centers of these pins, it is only necessary to locate from one edge of the templet, and make the center distance equal to the center distance of the holes in the work. The only calculations required are those for obtaining the 9/64- and 17/64-inch dimensions. It will be seen that these are the differences between the radii of the two holes in the work and one-half the width of the keyway. For example, 11/32 — 5/64 = 17/64 inch.

In use, the templet is placed on the work, as shown, so that the pins will seat snugly in the lowest part of the bores, and it is held in this position while a line is scribed along the upper edge of the templet to locate the lower side of the keyway. The pins in the jig project equally on each side of the 1/16-inch plate, so that by turning the templet over it may again be used for locating the other side of the keyway, the pins then being diametrically opposite the position occupied when scribing the first side of the keyway. After these two parallel lines have been scribed, an 11/64-inch plug is inserted in the hole and a strip of steel, 5/64 inch thick, is laid tangent to it and perpendicular to the center line, so as to furnish an approximate location for scribing the depth to which the keyway is to be cut.



Templet for laying out Keyways in Work which does not have Parallel Side

Perhaps the greatest time-saving feature of this simple templet is the provision for using both sides by simply permitting the pins to extend through the plate. Referring to the view at *A*, it will be seen that if this method of assembling the pins is not followed, a tapered templet is required so that the pins may be located perpendicularly and equidistant from both angular sides. The calculations involved in laying out the center distance of the templet would also be more complicated. A templet of the type described will be found to effect a considerable saving in time in laying out a keyway, as it requires only about thirty seconds per piece.

Wilkinsburg, Pa. WILLIAM S. ROWELL

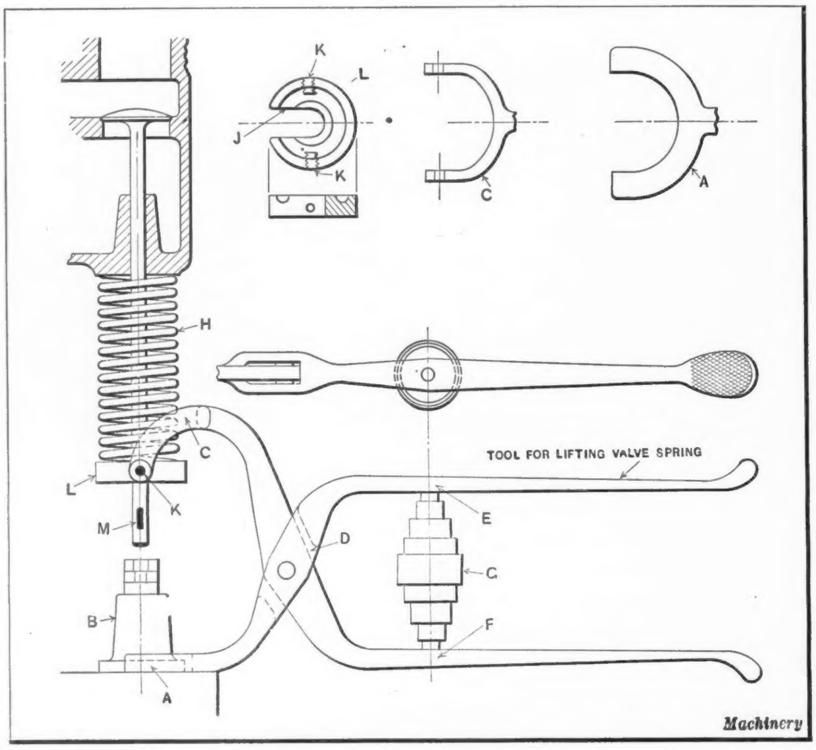
TOOL FOR LIFTING ENGINE VALVE SPRINGS

The valve spring lifter shown in the accompanying illustration has proved useful in removing the valves from gasoline engines. It is easily made and differs somewhat from the conventional type of valve spring lifter, which is often found to be more cumbersome than convenient. The tool consists of a pair of tongs, the two halves of which are forged from steel. A fork *A*, which will straddle the valve tappet guide *B*, is forged at the end of one member. The other member is also made with a forked end *C*. It will be clearly seen from the illustration that this half, owing to the forked end, will not pass through the slot at *D*, and must therefore be made in two pieces and welded after the tongs are riveted together. After assembling, the handles are filed and checked at the ends as indicated in the illustration.

Pins are fitted into the handles at *E* and *F* which position the spring *G*. A steel pad *L*, grooved to fit the end of the valve spring *H*, and slotted as shown at *J* in the detail view, is placed in fork *C*, where it is held by two pins *K* which allow it to swivel. To remove a valve it is only necessary to compress the handles and insert

the tongs under the valve spring *H* as indicated. When the handles are released, spring *G* causes the tong ends to be forced apart, thus compressing spring *H*. This permits the valve cotter-pin *M* to be easily removed, as both of the workman's hands are left free for this work. By assembling pad *L* in the fork so that it can swivel, it will automatically align itself with the valve spring *H*, so that there is no danger of the tongs slipping or flying out of position due to the pressure exerted by the spring. It is a simple matter to release the tongs and remove the valve spring after the cotter-pin has been removed. By the use of this tool, valves can be quickly and conveniently removed.

Cleveland, Ohio C. F. George



Tool for lifting Valve Spring to permit Removal of Valve

WORK-HOLDER FOR THREAD-MILLING OPERATION

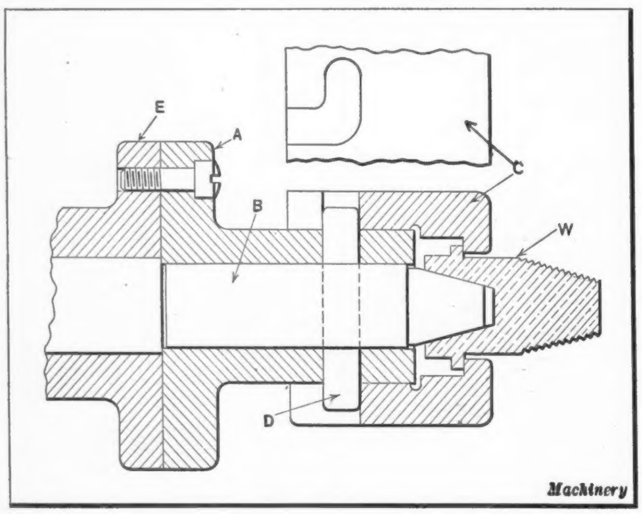
The work-holder described in the following was designed as a special holding means for the brass plug *W* which is shown located in the holder in the accompanying illustration. The operation performed on this brass plug was the milling of taper threads, the holder being attached to a thread-milling machine, although the design lends itself to application to other machines. In the present installation it was impossible to make use of the tail-center as a support, so that other means had to be employed to chuck the work securely. Consequently in the design of this special holder advantage was taken of the surfaces which were previously finished true with the portion on which the threads were to be milled, and these surfaces are those by which the work is shown located in the illustration.

The spindle of the thread-milling machine is indicated at *E*, and the adapter or body of the holder, which is attached to the spindle by means of fillister-head screws, at *A*. This adapter extends out from the head of the machine a sufficient distance to to allow clearance for the operation of the cutter-head of the machine. The construction also provides a rigid support for the tapered plug *B* which locates and helps to drive the work. Pin *D* is a driving fit in the adapter and plug, and holds them together. The projecting ends of this pin form lugs which engage bayonet lock slots in ring *C*. By this construction the locking ring *C* can be readily slipped in place, and brought up against the collar on the work, a slight turn securely holding it on the tapered end of plug *B*. The bayonet lock slots in which pin *D* engages are so machined that they have a slight angle relative to the face of the ring, and so enable the ring to be drawn in and securely bind on the collar of the brass plugs *W*. All that is necessary, then, in chucking work with this special holder is to first place the work on plug *B* and slip the locking ring over the work until the slots engage the ends of pin *D*, after which by a slight rotation of the ring, the work is securely held by the pressure exerted on the flange of the work.

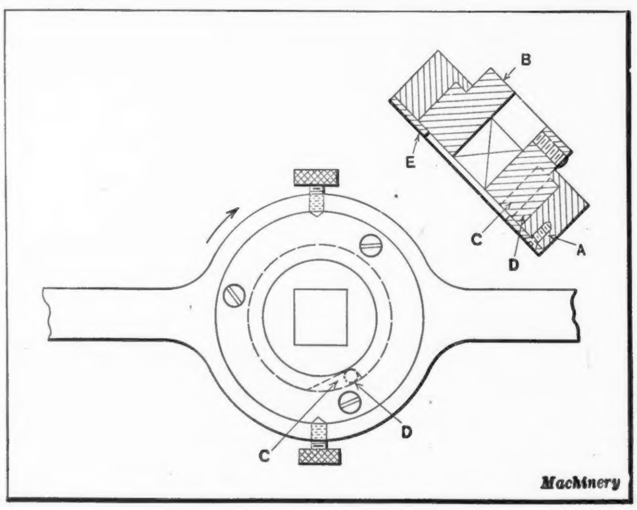
B. S.

REAMER WRENCH

There is a tendency for boys and semi-skilled men, especially if they have ever performed any hand-tapping work, to back a reamer out of a finished hole the same as they would a tap. It is, of course, known to all mechanics that a reamer should be rotated in the same direction, both in reaming the hole and in withdrawing the reamer from the work. If this is not done, the reamer quickly becomes dull, and the surface which has just been finished is likely to become scratched. A reamer wrench which was designed to prevent this occurrence, and which is extremely simple in construction consists of a die-stock in which a suitable



Work-holder for Thread-milling Operation



Slip Wrench for Hand Reaming

holder A is held by means of two thumb-screws. The holder is bored to fit a bushing B which is provided with a square hole for about two-thirds of its length and with a round hole for the remainder, so that it may fit the end of the hand reamer. The reamer is secured in bushing B by a headless set-screw. The periphery of the bushing contains a tangential slot C which is milled to a sufficient radial depth so that roller D may be housed between the bushing and the holder A and be free to revolve when located in the deepest part of this cut-out. The holder is provided with a plate E, screwed to the face to hold the parts together. The wrench is designed to operate similarly to a roller clutch, it being at once evident that after the wrench has been slipped over the end of the reamer and the set-screw which holds it to the shank tightened, rotation in a clockwise direction will cause the roller to bind in holder A and drive the reamer; also, reversal of direction of rotation will result in the roller becoming pocketed in the cut-out section of holder A and thus prevent movement of the reamer. The device is simple and fool-proof, it being absolutely impossible to back the reamer out of the hole when roller D is not wedged against the bore in the holder.

Rosemount, Montreal, Canada HARRY MOORE

PATTERN CORRECTIONS

While it is impossible for the patternmaker to foresee all the difficulties that the molder may encounter, it should, nevertheless, be possible to minimize these difficulties by encouraging closer cooperation between the molder and patternmaker. An effective method of promoting such cooperation, even when the foundry is situated at a considerable distance from the pattern shop or even in another city, is to see that all pattern changes made at the foundry, and all reasonable suggestions that the molder can make to improve each pattern, be recorded on the pattern drawing and given to the patternmaker. By this practice the patternmaker will obtain a more intimate knowledge of actual foundry practice, and as a result, be able to construct better and more practical patterns. Where this practice has been followed, excellent results have been obtained, and the possibility of making the same mistake twice is eliminated.

Kenosha, Wis. M. E. DUGGAN

DIMENSIONING SPLINE MILLING CUTTERS

Cutters used for milling splines must be very accurate in order to yield the required results. To furnish a toolmaker with dimension A, at the left in Fig. 1, and the included angle of the cutter teeth is not sufficient, since the usual gaging equipment does not make it possible to measure these accurately. The simplest way for a toolmaker to measure the cutter teeth is to use a vernier gear-tooth caliper and work to dimensions B and C, these dimensions being, respectively, the greatest width and depth that the cutter mills to. The method of computing these figures trigonometrically will be given in the following. As a check on the calculations it is advisable to lay out half a spline and space as shown in Fig. 2, either ten or twenty times actual size.

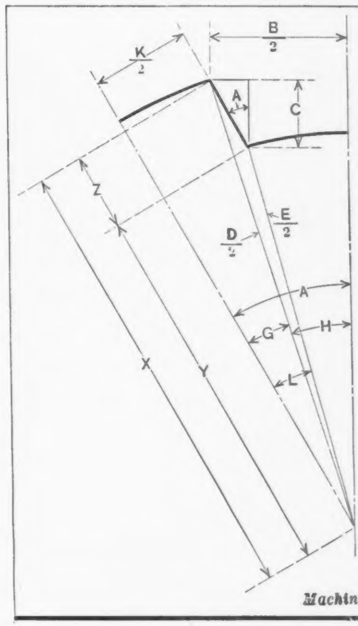


Fig. 2. Diagram used in computing Dimensions B and C, Fig. 1

From reference to Fig. 2 it will be evident that if N = the number of splines to be cut on a part, $A = 360 \div 2N$. Also,

$$\sin G = \frac{K}{D},\ \sin L = \frac{K}{E},\ \text{and } H = A - G. \text{ Therefore,}$$

$$B = D \sin H. \text{ Again, } X = \frac{D}{2} \cos G,\ Y = \frac{E}{2} \cos L, \text{ and}$$

$Z = X - Y$. Thus, $C = Z \cos A$. While this computation involves a little more work for the drafting-room, it will be much appreciated as a time-saver by the toolmaker. The data given on the drawing of the part for which a cutter is intended should consist of the dimensions D, E, and K, on the sectional view shown at the right in Fig. 1, and the number of splines.

Detroit, Mich. H. P. LOSELY

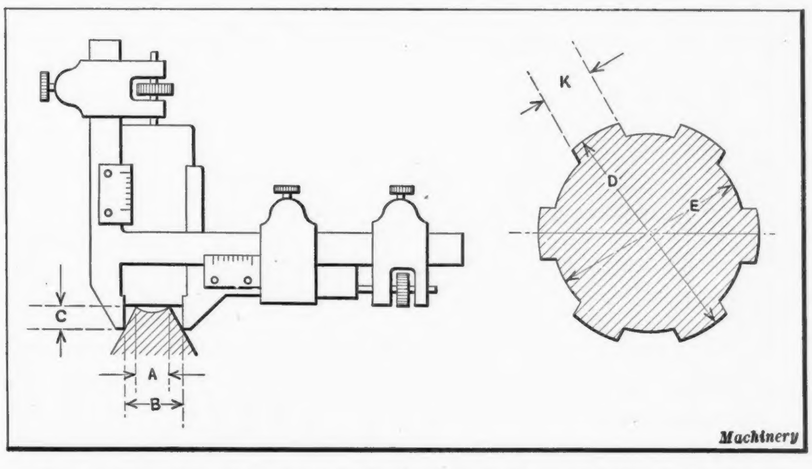
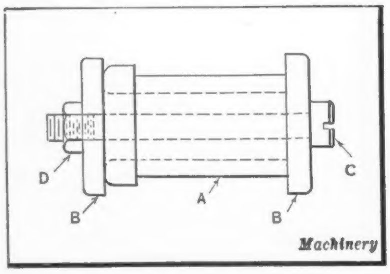


Fig. 1. Dimensions which should be furnished on Drawings of Spline Milling Cutter, and Part to be milled

SHRINKING DRILL BUSHINGS TO DECREASE SIZE OF HOLE

Every toolmaker has undoubtedly had the misfortune to grind or lap the holes in a set of drill bushings to a size larger than was intended. In most cases this means that new bushings must be made to replace the ones having over-size holes. This, of course, results in a loss of time and material. The general procedure in making a drill bushing is to drill, and ream or bore out the hole; then rough-turn the outside diameter. The bushing is next hardened and put through a grinding and lapping process, which usually consists of first lapping the hole and then grinding or lapping the outside to the right size, care being taken to keep the outside concentric with the finished hole. If it should happen that too much stock is removed during the inside grinding or lapping operation, and this is discovered before the final outside finishing operation is performed, there is still a way to save the work if the error is within reasonable limits.

The method is to shrink the bushing to a size which will permit the grinding and lapping tools to be used again for finishing the hole to the correct size. The accompanying illustration shows the method of preparing the bushing for the shrinking operation. The bushing A is covered at both ends with thick washers B, which are tightly clamped to the ends of the bushing by means of screw C and nut D. The whole assembly is next brought to a red heat and then plunged in a cold bath. The cooling liquid is prevented from entering the hole in the bushing by the



Drill Bushing Ready for Shrinking

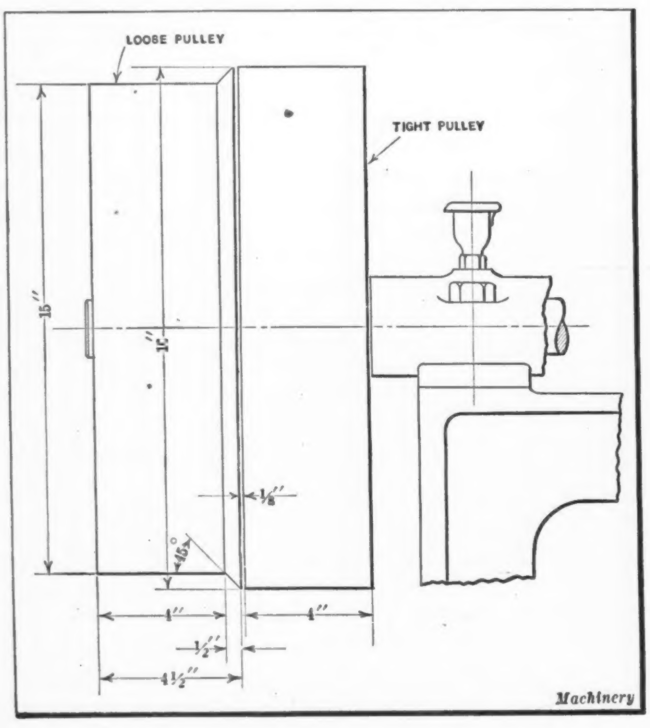
washers. As a result, the inner portion of the bushing shell, while still hot and soft, is contracted by the outer portion of the shell which is more quickly cooled and contracted by the cooling liquid. If required, this operation can be repeated, but the washers must be tightened each time. Bushings ¼ inch in diameter and up may be shrunk in this way so that the holes will be 0.002 inch smaller in diameter.

New York City C. G. Youngquist

LOOSE PULLEY DESIGN

Belt-driven machines equipped with loose pulleys are seldom in operation all the time that the power is on. Under the most favorable conditions of continuous production, the idle time of the machine is usually in excess of 10 per cent of the total working day. Certain machines, which, from the nature of the operation, must be frequently stopped and started, are often idle 50 per cent of the working day. Under the best conditions, then, the drive belts of nearly all machines are running on the loose pulleys for a considerable part of every day.

Loose pulleys have long been recognized as necessary evils. Their bearings run hot, wear bell-mouthed, and quickly become a loose fit on the shaft. They are difficult to oil, and are generally avoided when an installation will bear the expense of a good friction clutch. A few manufacturers, recognizing these troubles, have adopted the pulley design shown in the accompanying illustration. It has the advantage of relieving the belt tension while the belt is on the loose pulley, thereby saving, not only the belt, but the bearing as well. The bearing pressure is lowered to such an extent that overheating is rare with this type of pulley, and the oil film is more readily maintained. A reduction in diameter of the loose pulley of 1 inch ordinarily reduces the belt tension about 150 pounds per square inch for a 25-foot belt. The resulting bearing pressure is usually low enough to permit the use of the so-called "oil-less" bushings of impregnated wood on pulleys which have previously been considered to be subjected to too severe service for this type of bushing.



Loose Pulley Design that relieves Tension on Belt

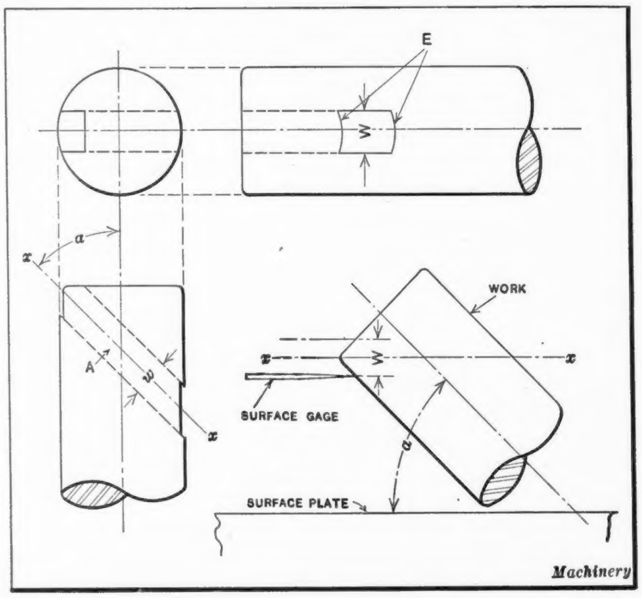
The difficulty of belt shifting is but little greater with this type of pulley than with straight-faced pulleys of equal diameter. To aid in shifting the belt, the conical portion of the pulley face should be inclined at an angle not greater than 45 degrees. Some designers use angles as small as 30 degrees, but the difference is hardly noticeable. The increased pulley face necessary to procure the lesser angle is not warranted by the results.

The loose pulley here described and illustrated is not new. It has been used for many years on the Universal Winding Co.'s machines and doubtless on many machine tools. Its adoption, however, has not been as general as its good features would seem to justify. A reminder of its purpose may result in its more general use on many machines now equipped with loose pulleys of the regular type, and thereby eliminate much of the trouble common to this type.

Philadelphia, Pa. John L. Alden

FILING SQUARE HOLES IN BORING-BARS

When a square hole such as indicated in the accompanying illustration at *A* is required in a round boring-bar for



Method of filing a Square Hole in a Round Boring-bar

the purpose of holding a square tool bit at an angle with the axis of the bar, it becomes necessary to file the hole square by hand if a slotter or some other suitable machine is not available. In filing holes or slots of this kind where the holes are held at an angle *a* with the axis of the bar, unsatisfactory hit-and-miss methods of procedure are often employed which can be eliminated if proper guide lines are scribed.

The view in the lower right-hand corner shows how the elliptic guide lines *E* can be easily scribed. Clamp the work to an angle-plate, with the axis *x–x* of the hole for the tool bit held horizontal and parallel to the face of the surface plate. Next set the scribing point of the surface gage at a point ½ *W* below axis *x–x* and scribe the lower lines. The scribing point should then be set at a distance of ½ *W* above axis *x–x* and the upper lines scribed in a similar manner. Care should be taken to keep the base of the surface gage in contact with the surface plate while scribing the lines. It will be noted that the upper line, in one instance, will be scribed on the end of the bar, while the lines on the opposite side will be located as shown at *E* in the upper view.

Cincinnati, Ohio J. F. Thornton

Industrial Conditions in Germany

From MACHINERY'S Special Correspondent

Berlin, November 9

GERMANY today presents a picture of millions of people working hard in consequence of the peace treaty and the London ultimatum, apparently with the aim of building up a great German market in competition with all other manufacturing countries. This aim is being realized due to the trade advantages offered by the continual lowering of the exchange value of the mark, which is seriously hampering the industries of surrounding countries and aiding the disposal of German-made products. In Holland there is practically no industry that is not suffering greatly because of the impossibility of competing with German manufacturers, and in some cases, notably in the machine-building line, the very existence of the industries is threatened. The number of working hours per week is generally less than in Germany, while the wages of employes are approximately three times as much. Recently the Dutch Indian colonies ordered materials for bridge and railway construction from German dealers. Conditions in Belgium and Switzerland are the same as in Holland. Swiss exports have dropped to one-half what they were a year ago, the watch, machine, and metal industries being particularly affected.

Italian and Russian Trade Relations

The Italian Government, in order to protect home manufacturers, has adopted a new high tariff. Of especial interest to machine tool builders is the fact that the tariff on machines weighing less than 10 meter-quintals (about 2200 pounds) is now 268 lire per meter-quintal (about 5 cents per pound, present exchange) instead of 9 lire per meter-quintal (about 0.17 cent per pound) as has been the case until recently. This increased tariff appears, at the present writing, to have put an end to German competition in Italy.

Arrangements made by the German Government with Soviet Russia have greatly improved business relations with that country. During 1920, Germany ranked second to Sweden in exports to Russia, but now Germany shows the strongest gains in that trade. Russian dealers and German manufacturers are cooperating to promote business between the two countries.

General Business Conditions

The manufacture of machine tools for home consumption is considerably less than for the export trade, although domestic demands have been satisfactory. Plants in the machine-building industries have orders for their products for months to come. However, production has been hindered by an insufficient supply of coal. American firms offered coal in September at 850 marks per ton F.O.B. Hamburg, while English coal was offered at 520 to 550 marks per ton F.O.B. Berlin. Iron and steel, automobile and railway car plants are all busy. Locomotive builders have sufficient work to last until January 1, but it is said that no orders are in prospect for completion after that date. It has also been reported that German locomotive builders have been underbid in South American countries by American concerns who also are able to extend credits for a longer period of time. Precision machines, optical goods and cameras are especially in demand in some countries.

Among the leading machine tool builders in Germany should be mentioned Ludw. Loewe & Co., Berlin, which firm has modernly equipped shops, and produces machinery well known not only in Germany but generally in the world's markets. This company is at present employing about 2600 workmen and 600 office employes. The plant has 3900 machines running, two-thirds of which are of the Loewe Co.'s own make. The total number of machines built in a year by the company is about 1600, and during the past year it declared a dividend of 24 per cent. Other plants reported as fully occupied are the Schubert & Salzer Ltd. of Chemnitz, which company paid 25 per cent dividends last year. The Wotanwerke Ltd. of Leipzig, specializing in shapers, paid dividends of 40 per cent, and the R. Stock & Co., Ltd. of Berlin-Marienfelde, twist drill manufacturers, have paid in the last three years, 25, 15 and 25 per cent dividends, respectively.

Owing to the large amount of business being done, the dividends paid out by machine tool builders generally vary from 8 to 25 per cent. Many concerns have increased their capital and some firms are combining their sales organizations. The Association of German Machine Tool Dealers has united with the Berlin Tools and Machine Tools Trade. In former days some antagonism existed between these two societies. The total amount of machine tools exported in 1920 reached 949,212 meter-quintals (about 104,632 tons) and was valued at 1,325,093,000 marks (about $5,300,400). About 190,500 meter-quintals were exported to Holland, 136,700 to France, 117,600 to Switzerland, 75,500 to Italy, 74,500 to Belgium, and 16,200 to Great Britain. The imports of metal-working machinery into Germany during the same year amounted to 10,105 meter-quintals (about 1115 tons).

The Labor Situation

Labor conditions have improved considerably. While the unemployed on the first of August amounted to about 358,000 workmen, this number was reduced to about 232,000 by September 1. There have been several strikes that interfered with regular production, but most of these have been settled without much difficulty. In a Dresden metal-working establishment a strike affecting 6000 workmen and lasting five weeks resulted in a failure for the employes. During that period the unions suffered a weekly loss of 5,200,000 marks (about $21,000) and the manufacturers, 65,000,000 marks ($260,000).

The Aluminum Industry

Experiments conducted during the war showed that aluminum could be obtained not only from pure clay, but from many inferior grades subjected to certain treatment. As a consequence the aluminum industry has been developed extensively in southern Germany where hydro-electric power is used in its production. Prior to the war the output of aluminum amounted to around 800 metric tons annually, while it is now about 32,800 metric tons.

Influence on Industry of Recent Fairs

The vast importance of the Leipzig fair is shown by the fact that more than 2,000,000 workmen are now occupied in filling orders obtained at this exhibit. The recent automobile exhibition in Berlin has also resulted in sales reaching into billions of marks. Some concerns received orders for more than 200 cars, and Belgian and Dutch dealers endeavored to reserve for themselves the entire production of a number of concerns. This industry employs about 150,000 workmen, and the total exports in 1920 amounted to between 21,000 and 22,000 cars and motorcycles.

Hanson-Whitney Semi-automatic Universal Thread Milling Machine

THE production of threads by milling has developed rapidly since 1900, and the single-cutter thread milling machine has become a standard tool, especially for external threads. Although the single-cutter type of thread milling machine has been used to a certain extent for internal work, it has not become as universal as the machine employed for milling screws. Even before the time mentioned, threads were made on gun work by a hob milling process; that is, a hob having concentric teeth corresponding in pitch with the screw to be milled was used in conjunction with a suitable lead-screw, and the screw was finished by setting the hob to the proper depth in the work and then feeding it endwise by means of the lead-screw; when the work had made one revolution, a thread was completed which was fairly accurate. There have been several developments along this line for such work as tap making and for cutting short threads on automobile parts, and also in places where a short thread only is wanted. Special machines have been made for internal as well as for external work.

The Hanson-Whitney Machine Co., Hartford, Conn., has produced a semi-automatic universal thread milling machine, designed to meet various conditions and to produce work of different types having external or internal threads especially when large quantities are required. Figs. 1 and 2 show front and rear views of this machine, which is of a very rigid design. The spindle is of a hollow type, and has a capacity for holding work up to 2 inches in diameter, but different headstocks can be used for larger diameters when necessary, and special holding devices are easily supplied to meet requirements. The illustrations show the machine with an ordinary cutting head, used especially for external work which can be held either between centers or in a chuck. Where the work is long and large in diameter, centers are used, and with the rapid adjustable footstock it is possible to hold the work very rigid.

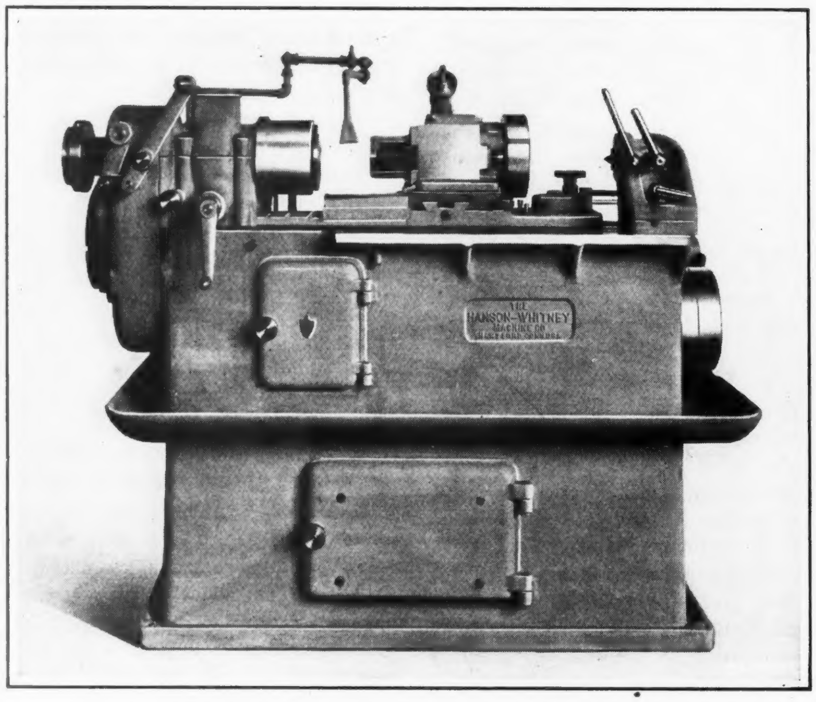


Fig. 1. Hanson-Whitney Semi-automatic Universal Thread Milling Machine

Operation of the Machine

The machine is partly automatic. The operator puts the work in the chuck and presses the button shown in front of the headstock; the carriage carrying the hob advances rapidly toward the headstock and then crosswise toward the work. When the hob almost touches the work, the motion is automatically changed to a proper feed motion; the spindle is revolving and the hob advances to the depth of the thread, and when the depth has been reached, the hob stays in the same position radially and advances according to the pitch desired. When cutting a right-hand thread, the hob moves axially away from the spindle, and when cutting a left-hand thread it advances axially toward the spindle. After the work has made a little more than one revolution, the hob automatically recedes a little more than the depth of the thread and traverses toward the tailstock a distance of about 3½ inches, leaving the work entirely free; then the machine stops automatically. The operator next releases the work and puts in another piece, and the machine repeats the sequence of operations. For internal work the hob has no outer support, but the process is the same. The hob automatically enters the hole, then feeds in to the proper depth; the work makes a little more than one revolution, the hob recedes, and traverses out of the hole, and the machine stops ready for the next piece of work to be milled.

General Features of Construction

Taper threads can also be produced by using taper hobs, and a compensating device can be employed for the taper desired. The capacity of the machine is for external diameters from 5 inches to ⅜ inch, and for internal diameters from 5 inches to 1 inch. All parts are well protected and well lubricated, and the slides are exceptionally long. The hob always rotates in the same direction whether machining internal or external work, or left- or right-hand threads. The direction is such that the hob tends to press the carriage down into the bed instead of lifting it. This prevents chatter, and is considered the principal reason for the smoothness of the work. On the right-hand end of the carriage, as shown in Fig. 1, is a knob handle by which the carriage can be adjusted longitudinally relative to the work. On the front of the headstock is a crank which can be used to operate the machine by hand when setting it up. Above the cutter-head there is a screw with a dial for adjusting the hob to the proper depth. The lead is controlled by a cam, and for different leads different sections are introduced into the cam. The cam is very accessible, being located behind the door on the upper part of the machine in the front. There are very few gears in the machine, and as the cams are cut with extreme accuracy, the lead of the milled thread is very accurate, especially when using a hob that has been finished after hardening. The lower door on the front has a tank attached to it for cutting lubricant, and the work is constantly flooded from a pump running at a constant speed.

Speeds and Feeds

The machine is driven by a single belt, and no slippage can take place that will alter the relation of the hob and the work. At the left in Fig. 2 is shown the speed-box for the hob, by means of which six speeds are obtained. At the right is another gear-box for the feed, and there are twelve feeds for each speed. This gear-box also includes the "hurry-up" motion, which is constant and is used for bringing the hob into engagement with the work, and also for withdrawing the hob. On the end of the machine there is a tappet disk which controls the slow and the fast feed. The slow feed, used while milling, is variable according to the material and diameter of the work. Where the thread is interrupted, as on a tap, the proper number of tappets may be applied to the disk, causing the spindle to move faster when crossing the flute, which saves considerable time, especially on taps of large diameter. All bearings in the transmission run in oil, and as ball bearings are used, very little power is required to run the machine.

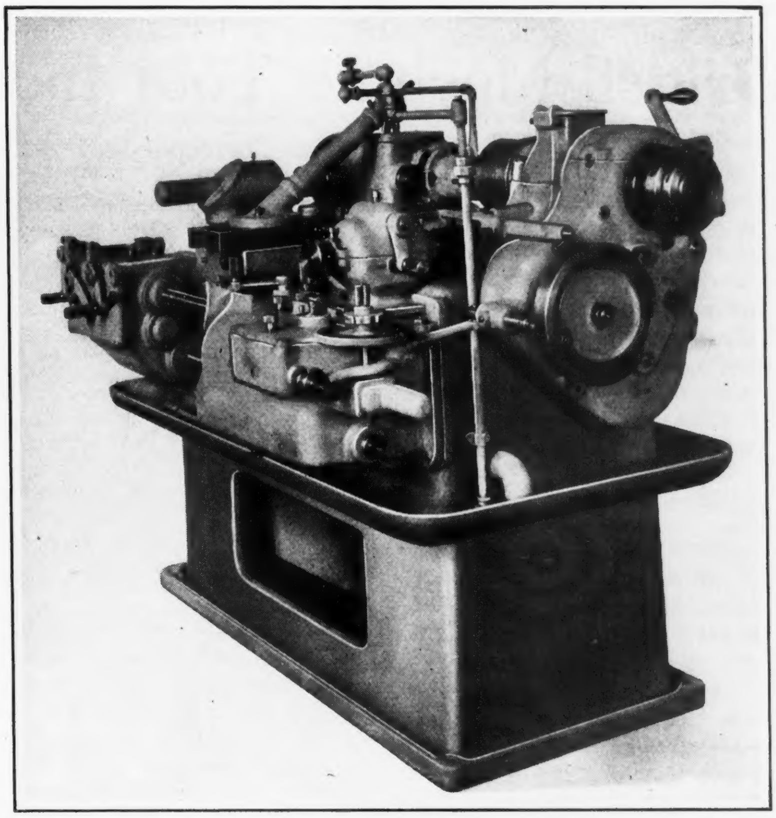


Fig. 2. View of Headstock End and Rear Side of Hanson-Whitney Thread Milling Machine

This machine is particularly adapted for threading parts such as are used in automobiles and airplanes, for cutting short threads on spindles, valve work, and for many other parts on which such threads are required. Excellent results have been obtained as to speeds and finish; for instance a machine steel bolt 2 inches in diameter with a thread $2\frac{1}{2}$ inches long has been threaded satisfactorily in forty-eight seconds. The machine is also built with a simple method of changing the speed and the feed by so-called "selective change-gears." These are particularly useful when work is being produced in large quantities, and changes of work are not so frequent.

* * *

THE MACHINE TOOL SITUATION IN GERMANY AND HOLLAND

By H. DRESES, Dreses Machine Tool Co., Cincinnati, Ohio

The following paragraphs give some of the writer's observations during a visit to Holland and Germany this summer and fall, relating particularly to the conditions in the machine tool trade and industry in those countries. The most important dealer in Rotterdam, Holland, had an immense stock of American, German, Swedish, and Swiss machine tools on hand. The prices, size for size, of American and German machines were approximately as 3 to 1. While the quality of the German machines may have been somewhat inferior, the dealer stated that it was impossible to sell American machine tools against this competition. In Germany, especially in Berlin and Cologne, the principal dealers had large stocks on hand, but not a single American machine tool could be found, it being stated that all that had been on hand were sold during the war.

The general conditions in Germany are very peculiar. A machinist, when the rate of exchange was 1.25 cents to 1 mark, received about ten times the wages, expressed in marks, that he received before the war, his pay averaging, according to locality, from 8 to 10 marks an hour. At that time this would have amounted to from 10 to 12 cents in American money, but at the present rate of exchange of 0.4 cent to the mark, his hourly pay would only be from 3 to 4 cents an hour. The overhead expenses and the cost of raw materials are also in the same proportion, as compared with prices in the United States, except that bronze and copper cost about the same as in this country.

The German shops are still busy, and in addition to supplying the home trade, obtain business from the surrounding neutral countries, South America, and even from former enemy nations. However, the selling of German machines and goods at about one-third of the world's market price cannot last indefinitely, as it is a terrible drain on the national wealth, and it can be accomplished only with the lowest wage rate, the most frugal living, and small or no profits.

In some quarters it is believed that the German Government and financiers have forced this state of affairs to bring about a reduction in the reparation payment, but this would be a dangerous experiment, because the low purchasing power of the mark, with the consequent starvation of the people, may bring about a revolution or a Soviet Government, as in Russia. German business men, financiers, and economists all agree that the breakdown is unavoidable, and that the consequences will affect the whole world.

What the drop in the rate of exchange really means is clear to only a few people. Suppose that the German General Electric Co. had 10,000,000 marks in the bank with which to buy American copper. At an exchange rate of 1 cent per mark, this is only $100,000; but when the exchange drops from 1 cent to 0.4 cent a mark, which recently happened within a week, it means that the capital of this firm in the bank has shrunk to $40,000, and consequently, within a week, the purchasing power of Germany for American copper and the export possibilities for copper from this country have been reduced by more than half.

If Germany succeeds in passing through the present crises without a revolution, the people will still have to exist, and can do so only by producing and living so cheaply as to crowd everybody else out of the world's markets.

* * *

The American Drop-Forging Institute, with headquarters in Cleveland, Ohio, has entered upon a campaign of publicity and educational promotion relative to the use of drop-forgings. The purpose of the campaign is to impress upon buyers and users of all types of tools and machines the importance of knowing whether or not all the parts subjected to strain are drop-forged. A book has been prepared for distribution entitled "What is a Drop-forging?" which can be obtained without cost upon application to the American Drop-Forging Institute, Hanna Bldg., Cleveland, Ohio.

The British Machine Tool Industry

From MACHINERY'S Special Correspondent

London, November 14

FOR the first time in many months signs of returning activity are discernible in industrial circles. As a direct consequence prospects in the machine tool field are brighter. Several valuable orders have been received by machine tool makers, and important inquiries from both home and overseas sources are in an advanced stage of negotiation.

Small Tools

Small tool makers report a steady trade. One maker of machine tool accessories, in announcing substantial price reductions, received a flood of orders. To enable the reductions mentioned—an amount approximately equal to 45 per cent of what other makers are asking for similar articles—to be made, the firm has been engaged for the last eighteen months in developing a series of semi-automatic single-purpose machines, of a simple yet effective type. On putting these machines into commission, the immediate result was an enormous cut in productive labor costs, and this has been passed along to the consumer in due proportion, with the results stated.

Foreign Trade in Machine Tools

Among the overseas countries who are in the market for machine tools, India, Japan, Belgium, and Poland figure prominently, in about the order named. On the Continent British made goods stand high, and there is a strong demand for machine tools and machinery of all kinds. Customers have expressed themselves ready to buy, but, unfortunately, the demand is no measure of the capacity to pay.

As far back as 1919 legislation was passed designed to overcome this fundamental difficulty by the institution of a credit scheme whereby advances were made to the buying country. The total amount allowed for such advances was £26,000,000. The scheme has been disappointing in its results, credits amounting only to about £1,300,000 being advanced, chiefly to Czecho-Slovakia and Rumania. The scheme has now been considerably modified. All countries are to come within its scope, and instead of each transaction having to come up for consideration before an advance is made, a total credit sum is specified for any particular firm, after due investigation. The British Government holds the exporting firm responsible for 57½ per cent of the credit, the risk carried by the Government being 42½ per cent.

Exports and Imports

The reports of imports and exports of machine tools for this year show that imports fluctuate in tonnage at a low level, about equal to the pre-war level, but for the last three months they have dropped below that level. The exports fluctuate above the pre-war level and tend to keep above that level. Exports for September amounted to over 1200 tons, the value being about £175,000. Imports remained under 200 tons and £25,000 for the month. The ratio of total value of imports to exports is as follows: Pre-war imports, 100; exports, 290. Current year imports to end of September, 100; exports, 432. The export values for September included nearly £70,000 for lathes alone.

Labor Conditions

After lengthy negotiations the wage reductions proposed by the employers have been agreed upon, and the so-called Churchill award of 12½ per cent bonus is to be foregone by workers in three stages, which will complete the reduction by the new year. As a result, manufacturers have already been able to base their costs on a definite labor charge, and in some cases are prepared to supply machine tools based on these 1922 costs. There should now be no inducement to hold back orders in the hope of further price reductions, and it is generally expected that machine tool prices will remain stationary when demand revives. In connection with the voting by the men on this wage reduction it is interesting to note that where trade conditions have been better than the average the vote against acceptance was the heaviest.

Unemployment continues to be severely felt throughout the country, and in the engineering trades the total number claiming employment benefit at the end of September was very nearly a quarter of a million, the figure being but slightly less than for the previous month. In Johnstone—the Scottish machine tool center—distress among the employes is promptly dealt with by the firms themselves, who each contribute weekly to a special fund administered by a municipal official. Each case is dealt with on its merits, and in view of the small population it means that the position of practically every worker and the circumstances in which he is placed are known.

The working days lost through labor disputes have of late been relatively few; in September 150,000 days were lost, whereas for the same month a year ago over a million days were lost. How much a part unemployment has had in bringing about this result it is difficult to say, but the prospect of being without anything to do has no doubt presented itself forcibly to all classes of workers. Trade union restrictions still remain a great hindrance. To cite only one instance, on the Mersey, oxy-acetylene cutters cannot be used unless the job is large enough to necessitate twenty-five men being at work. As another instance of a shortsighted and disastrous policy, unions stipulate that in foundries the less skilled men who look after molding and other machines must be paid at the same rate as the skilled hand molder.

Prices of Material

Attention is being rapidly concentrated upon the vital question of the price of coal. Just now the coal market is in such a state of chaos that it is difficult to state a figure for the average price today. Reports are current that certain collieries are offering large spot lots at such prices as 10 shillings per ton (about $2, present exchange) or even less, while the price of coke in these districts has been reduced in a sensational manner from over 30 shillings ($6) per ton to 22s 6d ($4.50). Needless to say, all such prices must be regarded as abnormal, and due only to immediate lack of cash, since an average figure of the actual net cost of raising coal to the pit head would exceed them. However, the iron and steel smelting interests are very definite in stating that unless fuel can be obtained at less than 20 shillings ($4) per ton there can be no resumption of production on anything approaching an adequate scale. Taking these facts into consideration, there is no getting away from the fact that the miners' wages will have to come down again very shortly.

Iron and steel makers have announced drastic cuts in steel prices. Round bars 3 inches in diameter and over have been reduced from £14 ($56) to £12 ($48) a ton

Sheffield makers of high-carbon acid steel have reduced the price of billets, specially made for the file trade, from £19 ($76) to £16 ($64) per ton. This represents one of the biggest cuts recently made.

In finished steel products there is a brighter tone. Some crucible steel firms have considerable work on hand, and are running full time. It is stated that the Russian Soviet Government has placed large tool contracts in Sheffield, and an order for 200,000 saws has just been completed.

British steel works are again benefiting greatly by the condition of the industry on the Continent; it is extremely difficult to place orders for delivery before the beginning of next year with either Belgian or German works, and only a few French firms are prepared to sell for shipment before December. Therefore, taking into account the early delivery of British works, the prices quoted go a long way toward meeting foreign competition, and to many inland points, upon which heavy railway freight rates have to be paid, continental goods are at a disadvantage as regards price.

The associated makers of high-speed steel in Sheffield have reduced their prices considerably, and 18 per cent tungsten steel has fallen from 3s 9d (75 cents) to 3s 3d (65 cents) per pound, while 14 per cent tungsten steel has dropped from 3s (60 cents) to 2s 8d (53 cents) per pound. Foundries are feeling the present pinch to the extent that many are working practically at cost. As an example, identical castings for which £45 ($180) per ton was paid a few months ago now cost only £24 10s ($98) per ton.

Machine Tool Prices

The price of machine tools has been retarding sales, and even when big concessions are made on existing prices by firms who are badly in need of money and must realize on their stock, buyers will not accept the assurance that a special quotation has been put forward, and always decide to wait for a still lower figure. Stock machines are being offered at a reduction of 20 per cent on prices which are really necessary today.

The sales of government machine tools are still being held in various parts of the country. At the beginning of this month a sale was held in Birmingham, and some machines, particularly some of the highest grade American makes, were disposed of at prices lower than would be obtained if sold as scrap. A planer built by the G. A. Gray Co., of Cincinnati, with a 12- by 3½-foot table and three tool-holders, which was in nearly new condition brought only £150 ($600). Nine Pratt & Whitney plain hand milling machines, with a 16- by 3½-inch table and collet chuck, packed in the maker's case unopened, brought from £13 ($52) to £19 ($76) each, while eight Pratt & Whitney three-spindle vertical profiling machines, weighing 3500 pounds each, with 14- by 12-inch table, in the maker's case unopened, were sold at £20 ($80) each. A hexagon turret lathe, made by the same concern, taking 1½-inch stock, which was in practically unused condition, brought £30 ($120), while a nearly new Warner & Swasey No. 6 screw machine swinging 18 inches, with a 2⅝-inch hole through the spindle, was sold for £20 ($80). A No. 4 screw machine of the same make brought only £16 ($64).

The whole situation regarding the disposal of government machine tools is admittedly unsatisfactory, and calls for some concerted action on the part of machine tool makers and dealers.

* * *

We are not a nation of machines, and houses, factories, and railways. We are a nation of men, women, and children. Our industrial system and our commerce are simply implements for their comfort and happiness. When we deal with those great problems of business and economics we must be inspired by the knowledge that we are increasing and defending the standards of living of all our people. Upon this soil grow those moral and intellectual forces that make our nation great.—*Herbert Hoover*

INDUSTRIAL CONDITIONS IN FRANCE

By MACHINERY'S Special Correspondent

Paris, November 12

There is hardly any buying in the machine tool market. The dealers have their stock-rooms full of machines which they are unable to sell in spite of the many concessions they make and the very easy terms they offer. Some manufacturers find themselves in the same position. A large firm in the vicinity of Paris actually has in stock more than 60,000,000 francs worth of machine tools, principally large machines. During the first six months of this year France imported about 22,000 tons of machine tools, while during the whole year of 1920 31,600 tons were imported. The majority of these imports came from Germany.

The machine tool industry, of all French industries, is the one which will be most affected by the recent agreement of Germany to deliver material in lieu of money. The situation is aggravated by the fact that the Government is bringing pressure to bear on the industries to make them buy this German material.

Very few orders seem to be given out by the railroads at the present time. This is due to the indecision concerning the management of the railroads as well as to the existing financial situation. Furthermore, the French railroads will receive 6200 repaired railroad cars and 4500 new cars from Germany. Two thousand of the new cars will be 20-ton freight cars, two thousand, flat cars of 20 tons capacity, and five hundred, cars of 40 tons capacity. This will tend further to retard manufacture in railroad shops in France.

An important association has just been formed which includes such companies as Cail, Fives-Lille, and Ernault, to manufacture locomotives for Rumania, and large shops are to be built in that country for the purpose.

It is to be hoped that, because of the tremendous success of the automobile show and the numerous inquiries obtained there, metal-stamping factories will start up again. Nevertheless, it is evident, when the productive capacity of the various manufacturers is taken into consideration, that very large orders would be necessary to maintain the factories in active operation.

In the foundry field there is hardly any activity, and there seems to be no hope for improvement. The importation of castings has increased considerably during the first six months of 1921, as compared with the same period of 1920. This seems abnormal, when the very low prices quoted in France for castings are taken into consideration. Probably this is due to the fact that parts of machines have been listed as castings. On account of the very few orders, prices of castings continue to fluctuate.

* * *

CONVENTION OF THE AMERICAN FOUNDRYMEN'S ASSOCIATION

The American Foundrymen's Association will hold its next convention and exhibit in the city of Cleveland during the week of April 24, 1922. The headquarters of the association will be in the new Cleveland Public Hall at Lakeside Ave. and E. 9th St., which is rapidly nearing completion, and the exhibits will also be shown there. The Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers will hold a joint convention with the association, as has been the custom in years past. The next meeting promises to be of unusual interest, as there never has been a period when economy in production was so important as now, and the exhibition will show the latest improvements and developments in foundry equipment.

* * *

A recent Commerce Report states that there are twelve factories in Austria engaged in the manufacture of tractors; but most of these factories are only partially devoted to this branch of the industry.

The Metal-working Industries

TO review conditions in the metal-working industries at this time without reference to general industrial conditions throughout the United States would be misleading. Of all the industries, those devoted to metal-working have without doubt felt the business depression most keenly and are among the last to return to a normal state. But every indication points to the fact that the lowest point of the depression in these industries was reached during the summer, and that there is a definite improvement at the present time. The iron and steel industry shows this gain to a marked degree. In the small tool field, the improvement noted in this review last month continues, and while the machine tool industry as a whole does not present so marked a change, many manufacturers report that sales during the last two months have been considerably above the average for the preceding months; still the activity is very slight, and active operation of the industry is not looked forward to for several months to come.

Taking the business situation as a whole into account, the progress toward recovery was somewhat interrupted a month ago by the theartened strike on the railroads. Nevertheless, from all parts of the country there are reports of slightly better conditions. There is a great deal more optimism, and while very few people are looking for a rapid improvement in the situation, the present rate of progress, if continued without interruption, will bring us back to a normal condition in a reasonable time. The Federal Reserve Bank of Cleveland in its November statement sounds a definite note of confidence in stating ". . . the time is near when business can safely throw away its crutches. Nearly all reports agree that the improvement shown last month is holding up well, and in some lines the production throttle has been opened another notch to meet the increase in demand. While there are still too many smokeless stacks in the steel section, the blowing in of furnaces is reducing the number. About this time last year the weakness in iron and steel was casting gloom over all kinds of business, this industry being regarded as the barometer of business. Then the cancellation of orders was a common occurrence. Today this barometer indicates a steady improvement.

"A year ago automobile and tire manufacturers were overstocked, and sales falling off. Recent reports indicate that sales are holding up well. Production is now being determined by demand. Last fall, building was hesitating in anticipation of lower costs. Labor troubles gave out a jarring note. The recovery this fall has been even more rapid than was expected. These developments are only a part of the transition—a transition not yet completed, but gradually working toward dependable business."

The Second-hand Market in Machine Tools

Many manufacturers have expressed a belief that the second-hand machine tool market will seriously affect the sales of new machinery for some time to come. It is generally supposed that there are available large quantities of used machinery, most of which is almost new or in very good condition. This view is not supported by the dealers in second-hand tools. Most of the machine tools offered today are so old or worn that the dealers will not consider putting them in their stock. Most of the good machinery from dismantled plants has already been offered and absorbed, and while occasionally a few good second-hand machines are available, the volume of this trade is not greater than it would be likely to be under normal conditions.

The second-hand machinery market seems large at present because of the very small business in new machinery. One dealer in used machinery says there are fewer used machine tools sold now than under normal conditions, because the market for used machinery, as well as for new machinery, is greatly reduced. Just as soon as reasonably normal conditions return, the influence of the used machinery market on the sale of new machinery will scarcely be felt—at least it will be felt no more than during normal times in the past.

There is very little government machinery still to be placed on the market; and while there are instances where firms which, in the past, would never consider anything but new machinery, have been induced to buy used machines on account of the saving at this time, it is not generally believed that those who have been accustomed to buying only new machinery will consider anything else in the future. Their buying habits will reassert themselves when their buying power is restored.

The Tool Equipment Business

A considerable change has taken place in the tool equipment business during the past months. Some of the concerns engaged in the designing and making of jigs, fixtures, gages, and special tools have discontinued altogether, which has lessened the very keen competition in this field during the last year, enabling firms established in the field to obtain business at figures which at least do not entail a direct loss. Taking the business of designing and building special tooling equipment as a whole, the last two months have shown a decided improvement, and at least one firm could be cited that is working at full capacity.

The number of concerns in this line that have gone out of business in some of the cities of the Middle West has thrown a considerable amount of machine tools on the second-hand market in those cities, which, for the time being, makes the supply of used machines exceed the local demand.

The Automobile Industry

Dealers in automobiles report that business continues well up to expectations for this season of the year, and in many instances the sales during October exceeded those in September. Further price reductions have been announced by some of the manufacturers of passenger cars and trucks. The reports from the different automobile manufacturers vary considerably, but on the whole production is showing the usual seasonal falling off. October shipments, according to the National Automobile Chamber of Commerce, were 11 per cent under those for September, and 4 per cent under those for October, 1920.

The Railroad Situation

Some of the western and southern railroads have requested the Interstate Commerce Commission to approve freight reductions averaging as much as 20 per cent. All classes of labor employed on the roads operating east of the Mississippi and north of the Ohio will soon be asked to accept wage reductions of 10 per cent, in order to make freight rate reductions in the East possible. One of the railroads in the Middle West has authorized the purchase of 55 locomotives, 127 steel passenger cars, and 7300 freight cars, while two other roads have purchased 3500 freight cars. This activity in buying will doubtless have a stimulating effect upon the industry in general.

Railroads in the Middle West have placed some orders for machine tools, but the buying of shop equipment is still limited to absolute necessities, and cannot be said to meet the actual requirements of the roads for the economical operation of their shops.

NEW MACHINERY AND TOOLS

THE COMPLETE MONTHLY RECORD OF NEW AMERICAN METAL-WORKING MACHINERY

How To Reduce Production Costs?

Triplex Combination Bench Machine

A COMBINATION bench type of machine which may be used for all operations done on regular bench lathes, millers, and drilling machines, thus reducing the amount of equipment ordinarily required in tool-rooms, has been developed by the Triplex Machine Tool Corporation, 18 E. 41st St., New York City. One of the unique features of this machine is the method of mounting the spindle head. It will be seen from Fig. 1 that the spindle head is mounted on an arm *A*, which has the form of an arc and which is graduated in one-half degrees to facilitate setting the head in any angular position between the horizontal and the vertical. The head may be clamped in position by tightening a single nut, and is balanced by means of a counterweight within the hollow column. The spindle is driven by a motor, which is attached directly to the head, and which, consequently, maintains the same position relative to the head regardless of the position of the latter. The drive to the head is by means of a belt running on two-step pulleys. The motor has a rating of ¼ horsepower, is reversible, and of the constant-speed ball-bearing type, its speed being 1750 revolutions per minute. As the motor is reversible, either right- or left-hand tools may be employed.

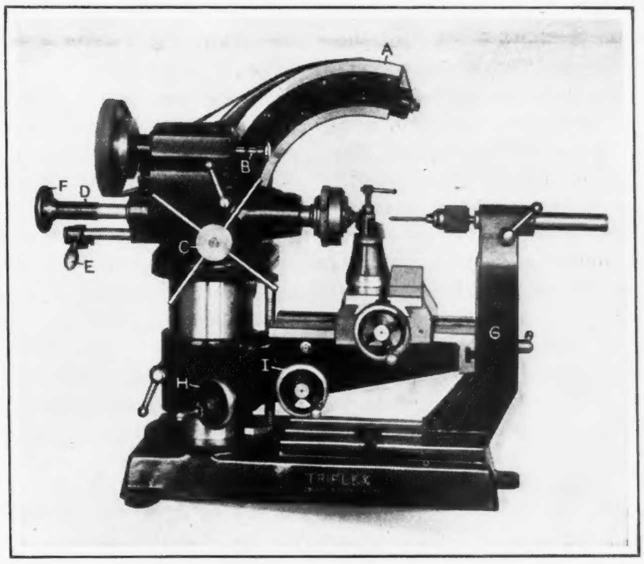


Fig. 1. Combination Bench Lathe and Milling and Drilling Machine brought out by the Triplex Machine Tool Corporation

Six spindle speeds are obtainable, the lowest of which is 90 and the highest 1150 revolutions per minute. These changes in speed are obtained by operating handle *B* which controls three shifting gears. The spindle can be fed a distance of 3 inches by turning the spider wheel *C*, and can be locked at any point by means of a clamping handle located above the spider wheel. The possibility of extending the spindle is particularly advantageous when some difficult milling and lathe work is being done.

The spindle is always fed by hand except when cutting threads, in which case it is fed by a master screw *D*, which engages a nut segment attached to handle *E*. The engagement is effected by swiveling handle *E*. The spindle is fed forward as it revolves, due to the engagement of the threads on the master screw

and segment. At the completion of a cut, the nut segment is automatically disengaged by the beveled edge on the hub of handwheel *F*. Internal threads can also be cut in a similar manner when a proper threading tool is used. Either a faceplate, collet, or chuck may be attached to the front end of the spindle.

The bed of the machine swivels on the column, and may be swung to one side so that high work may be placed on the base, which is provided with three standard T-slots for bolting down the work. In Fig. 1 the outer end of the bed is supported by an upright member *G* which can be removed when not needed. This upright is provided at the upper end with a socket in which may be inserted a center for holding work between centers, or the shank of a chuck as shown. The bed is raised and lowered on the column by rotating handwheel *H*, and the carriage is fed longitudinally on the bed by handwheel *I*. The transverse feeding of the carriage slide is accomplished through the operation of the handwheel on the front of the carriage. The various handwheels are provided with dials graduated to 0.001 inch. The carriage can be clamped in any longitudinal position, and the bed in any angular position. By swinging the bed the required amount, any degree of taper, in either direction, can be turned on work. Graduations on the column bearing of the bed facilitate these settings.

Milling operations can be performed by mounting a cutter on an arbor supported between the spindle and the tailstock center, or end-milling operations can be accomplished by inserting the cutter in a spring collet in the spindle, as shown in Fig. 2. The spindle head is shown in an angular position on its arm in this illustration. Fig. 3 shows the head in a vertical position, the machine being used as a bench drilling machine. A Jacobs drill chuck having a capacity for drills up to ½ inch in diameter is supplied. Some of the specifications of the machine are as follows: Longitudinal feed of carriage, 10 inches; transverse feed of carriage slide, 6 inches; vertical feed of bed, 4½ inches; maximum swing over carriage, 8 inches; maximum swing over bed, 14½ inches; maximum center distance, 14 inches; maximum height with spindle in vertical position, 43 inches; weight of machine, about 450 pounds; and bench space required, 16 by 25 inches.

COLBURN NO. 6 HEAVY-DUTY DRILLING MACHINE

The Colburn Machine Tool Co., 1038 Ivanhoe Road, Cleveland, Ohio, has recently added to its standard line of drilling and boring machines, a No. 6 heavy-duty drilling machine, designed especially as a production tool, a variety of work being accommodated due to the wide range of speeds and feeds obtainable. The machine is built with either a plain or a compound table in a single-spindle style, or with a plain table in gangs of two, three, or four spindles. Fig. 1 illustrates the single-spindle machine equipped with the compound table, while Fig. 2 shows a two-spindle machine having a plain table.

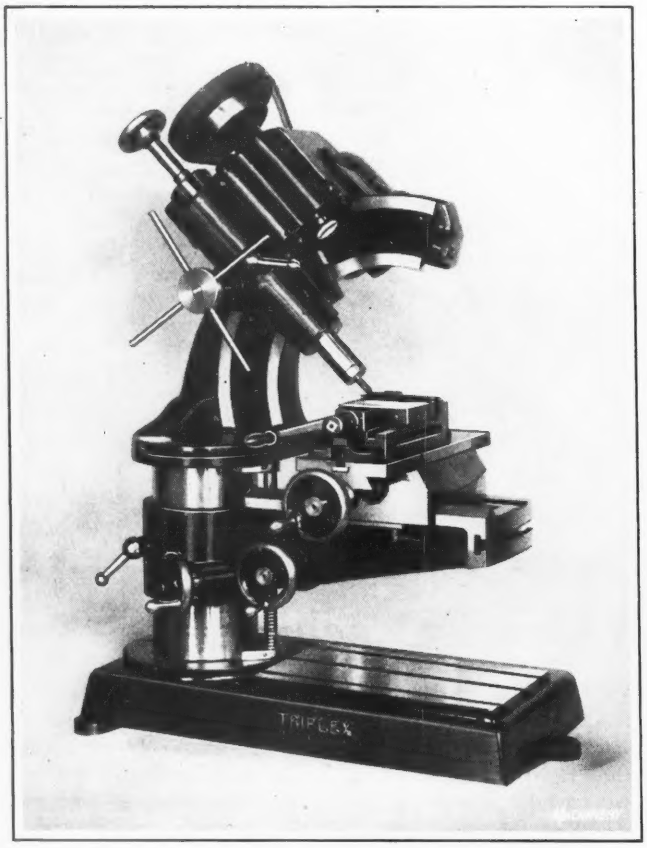


Fig. 2. Performing an End-milling Operation with the Spindle in an Angular Position

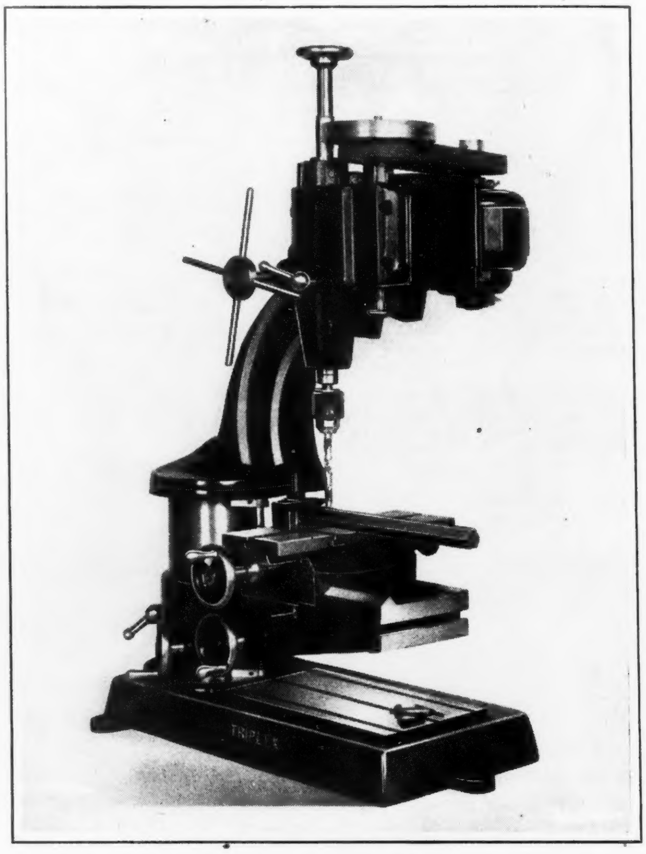


Fig. 3. A Drilling Operation in which the Spindle is placed in a Vertical Position

The machine has a column and base cast integral, to the top of which is bolted the head casting. The lower section of the column contains a storage tank for cutting compound, openings on each side of the column affording access to this tank. A flexible pipe returns the compound from the table to the tank. The head casting serves as an oil-tight box for the gearing. The speed and feed gearing run in oil, and all other gearing is lubricated by a splash system. All vertical bearings are lubricated by means of wicks. To suit work of such a height that it cannot be placed between the table and the spindle, a special extended base having two T-slots and a finished surface may be furnished. In order to place work upon this base the regular table must, of course, be removed from the machine.

The spindle has a No. 5 Morse taper socket, is double splined to equalize the working strain, and slotted across the lower end to provide a means for driving large boring tools. A small slot in the side of the spindle is employed for keying drills or other tools to prevent them from turn-

ing during an operation. The spindle is driven at its largest diameter and near the lower end, by a heat-treated chrome-nickel steel bevel gear. The spindle sleeve is bronze-bushed, and has rack teeth cut directly on its surface. A self-aligning ball bearing takes the thrust between the spindle and the sleeve.

The speed change-box is located on the left-hand side of the head near the back. It has an oil-tight cover which may be readily removed to enable the gears to be changed to give the desired spindle speed. Two speeds are obtainable with each pair of change-gears by transposing them on the driving and driven shafts, while two more speeds are obtained by means of sliding gears operated by a lever at the front of the machine. A set of change-gears may be furnished, which, with the combinations of change and sliding gears, will give forty-eight spindle speeds ranging from 30 to 375 revolutions per minute. The regular equipment consists of one pair of speed change-gears, giving four spindle speeds as described.

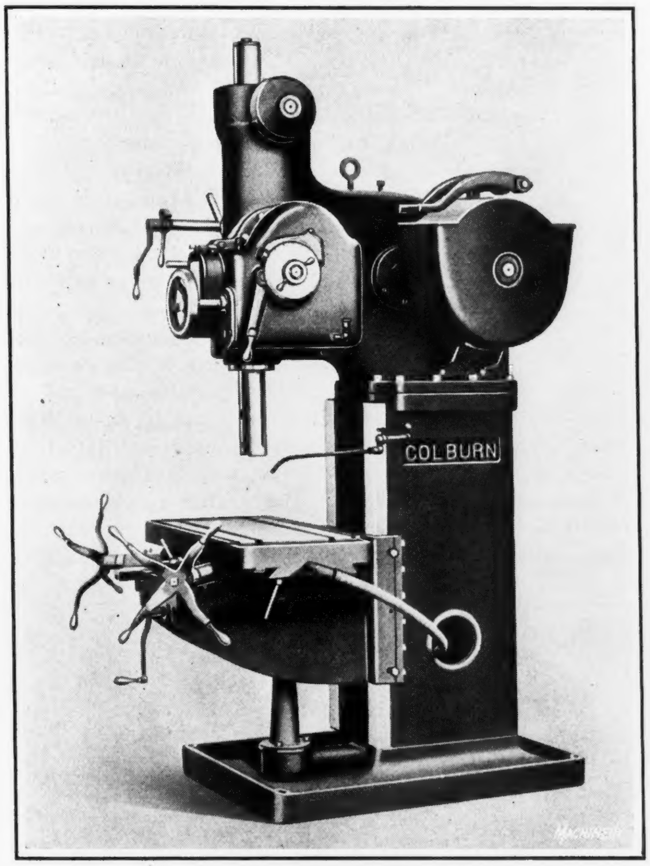


Fig. 1. Single-spindle Heavy-duty Drilling Machine made by the Colburn Machine Tool Co.

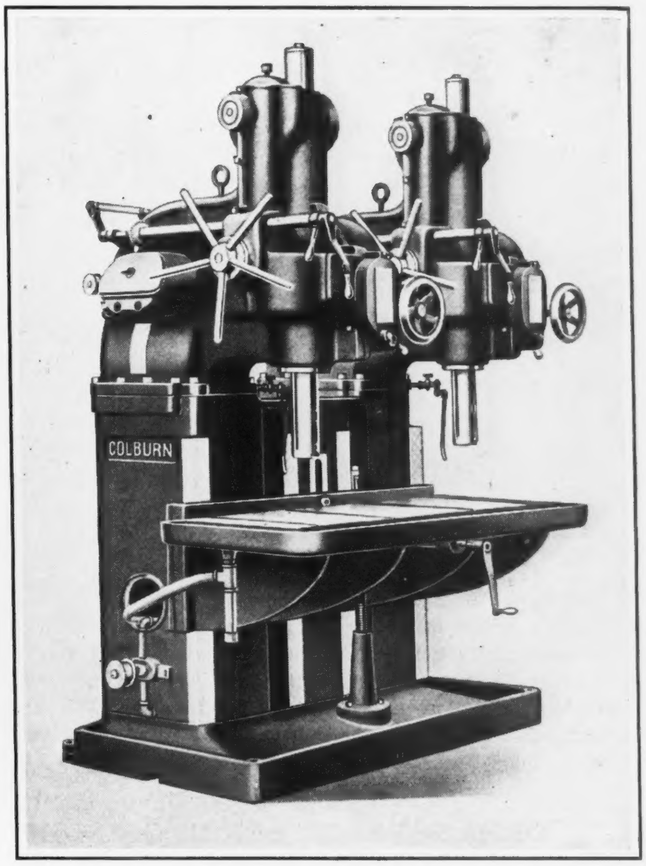


Fig. 2. Colburn Two-spindle Drilling Machine equipped with a Plain Table

The feed-box is located at the front of the head near the feed handwheel, as shown in Fig. 3. The various feeds are obtained in a similar manner to the different speeds, that is, by changing two gears in the feed-box. Two rates of mechanical feed are obtainable with each pair of change-gears by simply moving the handwheel either in or out. By moving the handwheel midway between the extreme inward and outward positions, the power feed is disengaged and the spindle may then be hand-fed by revolving the handwheel or the capstan wheel on the side of the head, the latter method being employed to obtain rapid movement of the spindle. With a complete set of change-gears, thirty-six feeds ranging from 0.005 to 0.134 inch per spindle revolution may be obtained. The feed mechanism is provided with a safety device, by means of which a pin is sheared, causing the feed to be stopped when the tool is operating under abnormal conditions, before any damage can result.

An interlocking device makes it impossible to change speeds while the machine is in operation, and this device also makes it impossible to start the machine until the sliding gears are fully in mesh. All control levers and handles are conveniently located at the front of the machine. An automatic tripping mechanism stops the feed when work has been drilled to the desired depth. The spindle is furnished with a spring counterbalance, the tension of which can be increased or decreased to suit the weight of different tools. The counterbalance also returns the spindle automatically after it has been tripped. A gear-driven tapping attachment having a ratio of 1½ to 1 is furnished when desired. This attachment is mounted on the driving shaft and driven by a pulley.

An oil-pan extends around the working surface of both the plain and compound tables. The elevating screw of the plain table is operated by a crank-handle, and is set off center to permit the boring of a hole through the table to accommodate boring-bar pilots. The compound table is mounted on a special knee and has rapid longitudinal and transverse movements, which are obtained through gearing actuated by the capstan handles. These are so arranged that the operator can readily manipulate the table in both directions while standing directly in front of the machine.

This machine may be equipped with a motor drive, provision being made for mounting the motor directly on the lower portion of the column at the rear. A motor of from 10 to 20 horsepower is recommended, the size depending on the work being done. The machine has a working capacity for driving 3-inch high-speed drills through steel. Some of its main dimensions are as follows: Distance from center of spindle to face of column, 14 inches; vertical adjustment of plain table, 13 inches; maximum distance between nose of spindle and plain table surface, 36 inches; compound table, 30 inches; and working surface of plain table, 20 by 24 inches, and of compound table, 18 by 30 inches.

On a machine of the gang type, each head forms a complete unit, this design permitting a number of heads to be mounted on a common column. All heads are interchangeable, a templet being used in drilling the bolt holes by means

of which the heads are secured in place. Each individual unit is driven by a constant-speed belt from a lineshaft and connected with tight and loose pulleys on the head. Thus, any spindle may be stopped or started independently of the others. The machine may also be driven from a countershaft attached to the rear. The table on three- and four-spindle machines is elevated by means of two screws, one at each end. A large capacity pump supplies coolant to all spindles. This pump is attached to the side of the column, and is driven from either the lineshaft or the countershaft.

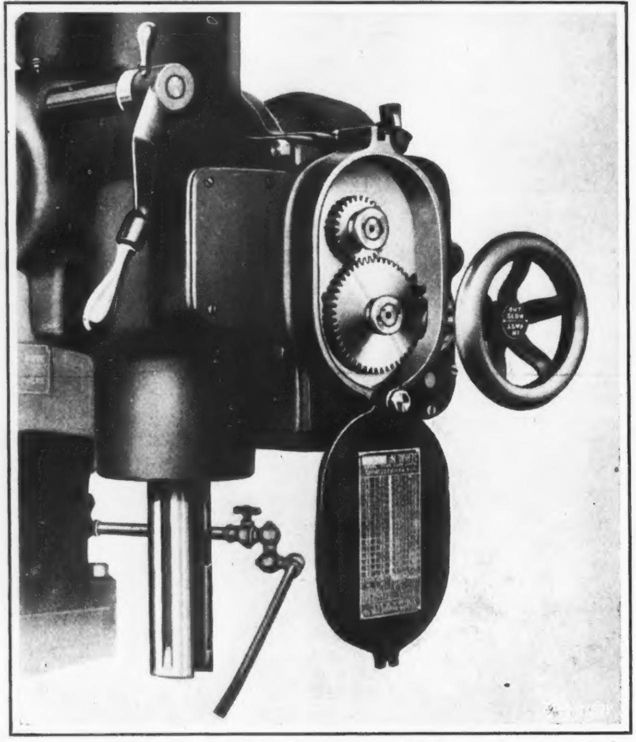


Fig. 3. Close-up View of Feed-change Box on Front of Spindle Head

The gang machine may also be equipped with a motor drive and tapping attachments. A ball-bearing countershaft is furnished with a motor-driven machine. The distance from center to center of spindles on gang machines is 35 inches. The table is 20 inches wide, and, on a two-spindle machine, 59 inches long.

VAN NORMAN "RELIO" BENCH GRINDING MACHINE

To meet the requirements of garages and automobile repair shops, the Van Norman Machine Tool Co., 160 Wilbraham Ave., Springfield, Mass., has developed the bench machine shown in the accompanying illustrations, which is suitable for grinding pistons, valves, wrist-pins, etc., re-

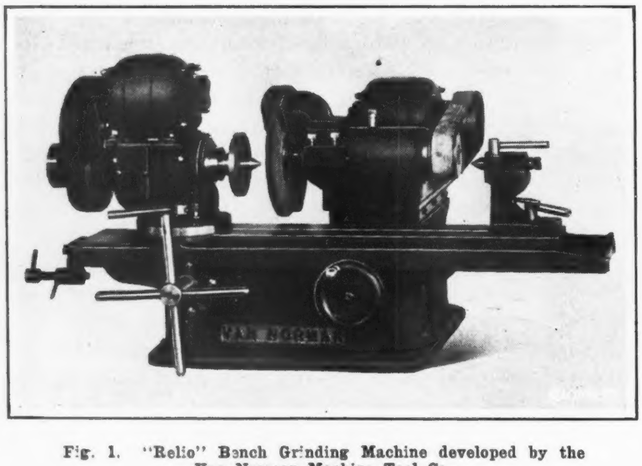


Fig. 1. "Relio" Bench Grinding Machine developed by the Van Norman Machine Tool Co.

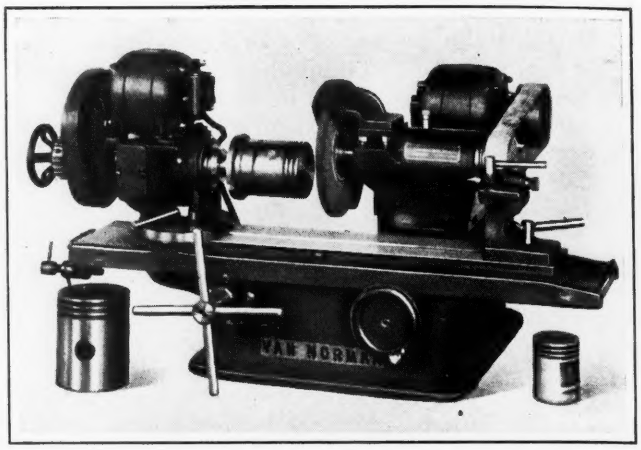


Fig. 2. Machine set up for grinding Automobile Pistons

grooving pistons, and for any other grinding or turning operation within its capacity. This machine is sold under the trade name of "Van Norman Relio." An individual motor drive is supplied for both the wheel- and work-heads, the wheel-spindle being connected to its motor by a belt, while the work-head spindle is driven through reduction gears direct-connected to the armature shaft of a motor mounted on top of the work-head. The wheel-spindle is equipped with ball bearings, and is located with its motor on a slide that may be moved transversely relative to the table.

The work-head spindle revolves in a taper bearing that may be adjusted to compensate for wear of the engaging surfaces. This head may be swiveled on the table and set at any angle from the center line of the table up to 50 degrees. Graduations on the base of the head facilitate these settings, and locating holes at 0, 30, and 45 degrees insure the same settings on subsequent pieces when grinding valves, reamers, etc. A tailstock is provided for holding work between centers when this method of support is desirable.

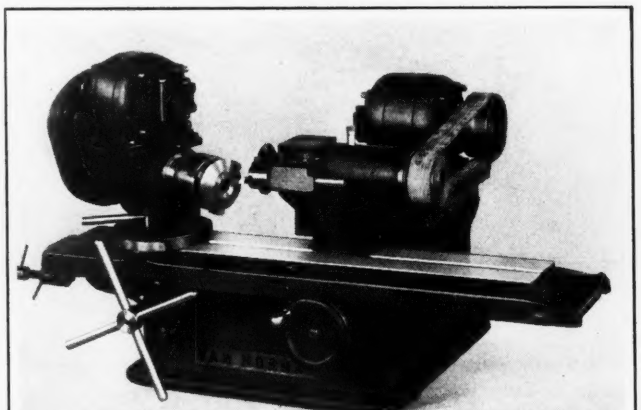


Fig. 3. Turning Angular Surfaces on the Van Norman "Relio" Bench Grinder

The table may be traversed past the grinding wheel through the rotation of a handwheel, and adjustable stops are supplied to limit this travel.

In Fig. 2 the "Relio" grinder is set up for grinding pistons, an attachment being mounted on the work-head spindle to enable the work to be quickly loaded and unloaded. Any standard piston with either straight or tapered sides can be accommodated. By removing the wheel and guard from the grinding head and inserting a special holder with a turning tool in a socket of the wheel-head in front of the wheel-spindle, the grooves for the piston-rings may be remachined. Another operation in which a turning tool may be effectively used on this machine is that of turning angular surfaces. This operation is illustrated in Fig. 3. The tool is fed over the face of the work by revolving the cross-

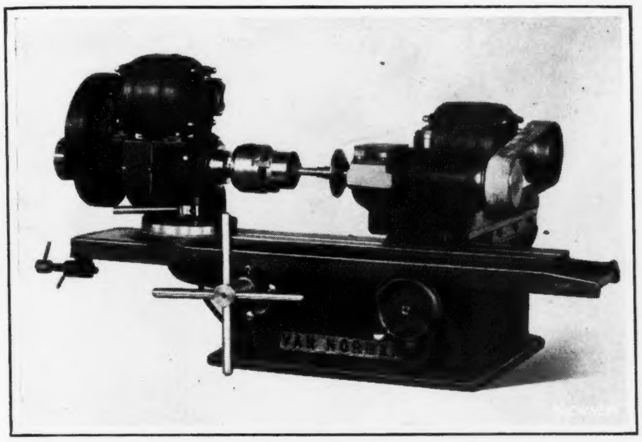


Fig. 4. An Internal Grinding Operation performed by attaching a Small-wheel Arbor to the Wheel-spindle

feed handwheel at the front of the machine. It will be seen that the work-head is placed at an angle to suit the angularity of the surface being machined.

Fig. 4 shows the machine set up for an internal grinding operation, a small-wheel arbor being attached to the front end of the wheel-spindle. Taper holes may be ground by setting the work-head to suit. Internal and external grinding can be performed at one setting of a piece of work by simply changing the grinding wheels. In the grinding of valves the head is set to the required angle and the valve stem is held in a draw-in collet chuck. It is stated that valves for standard cars are ground in less than one minute. Such an operation is illustrated in Fig. 5. Other operations readily accomplished on the machine are the grinding of wrist-pins, in which the work is held between centers and rotated by a key or pin inserted in the center of the work-head, provision being made for holding a wheel-truing tool on the tailstock; the grinding of tapers on valve cages;

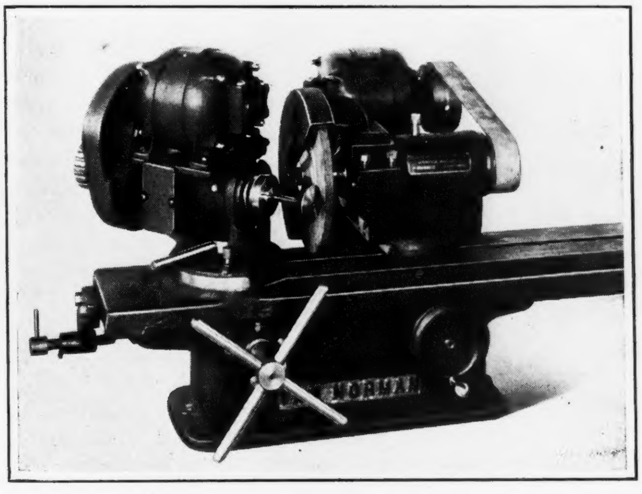


Fig. 5. Grinding an Automobile Engine Valve with Work-head set in an Angular Position

the grinding of valve reamers, in which a support finger is placed under the reamer teeth as they are being ground; and the repairing of armatures. In the last operation, the work is mounted between centers, and the worn parts may be finish-turned, scored or ground.

Some of the specifications of the machine are as follows: Size of grinding wheels, 8 by 1/2 inch and 1 by 1/4 inch; swing of work-head, 8 inches; distance between centers, 12 inches; travel of table, 10 1/2 inches; capacity of draw-in collet, 3/4 inch; bench space required, 3 by 4 feet; size of wheel-head motor, 1/4 horsepower; size of work-head motor, 1/8 horsepower. Low and high speeds of work-head spindle, 63 and 170 revolutions per minute, respectively; motor speeds, 1700 revolutions per minute; speed of wheel-spindle, 2800 revolutions per minute; and weight of machine, approximately 330 pounds.

ST. LOUIS POLISHING MACHINE

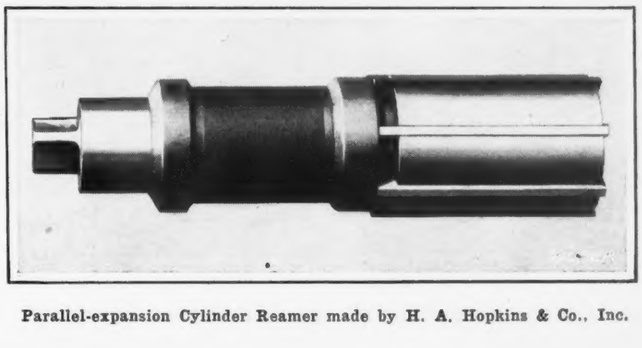
Another polishing machine known as the "Western" No. 10 has been added to the line of polishing and grinding equipment built by the St. Louis Machine Tool Co., 932 Loughborough Ave., St. Louis, Mo. The machine has a wide-face pulley and long bearings for the wheel-spindle, the bearings having large oil reservoirs and being amply provided for filling and draining. Circulation of lubricant is accomplished by means of chains. It will be seen that the lower half of the bearings is cast integral with the column. The arbor is made from 0.40 carbon steel, and has extra coarse-pitch

"Western" No. 10 Polishing Machine built by the St. Louis Machine Tool Co.

square threads. The machine may be furnished with taper-point arbors, either right or left, when desired. A few of the principal dimensions are as follows: Length of arbor, 48 inches; distance between wheels, 38 inches; and height from floor to center of arbor, 34 inches.

"RANSOME" PARALLEL-EXPANSION REAMER

An expansion reamer known as the "Ransome" has been developed especially for remachining automobile engine cylinders, by H. A. Hopkins & Co., Inc., 301 Laporte Ave., South Bend, Ind. It is made in five sizes to cover cylinders ranging from 2 3/4 to 4 inches in diameter. Each reamer is suitable for cylinders varying not more than 1/4 inch in diameter, and has an extra expansion of 1/16 inch to allow for regrinding of the reamer blades. The tool consists only of a body, nut, and blades. The latter are anchored to the body by means of flanges that engage slots in the body. This construction eliminates chatter and always presents



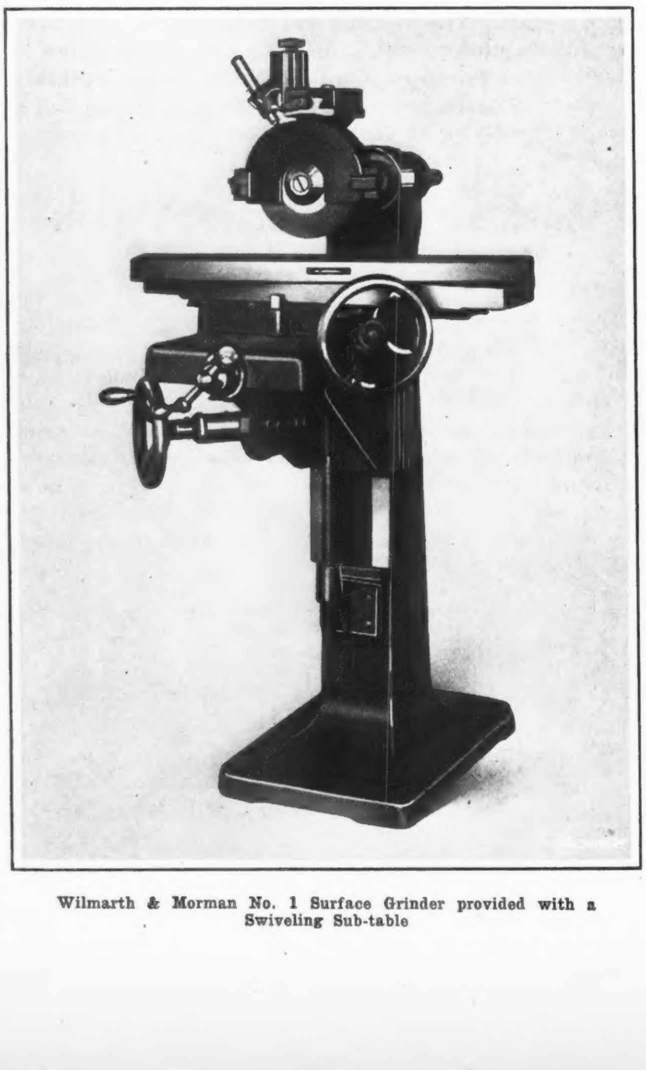
Parallel-expansion Cylinder Reamer made by H. A. Hopkins & Co., Inc.

an even cutting edge. The blades have a pilot end that permits them to be entered into the cylinder a short distance before any cutting is done, the reamer then being adjusted to the required size.

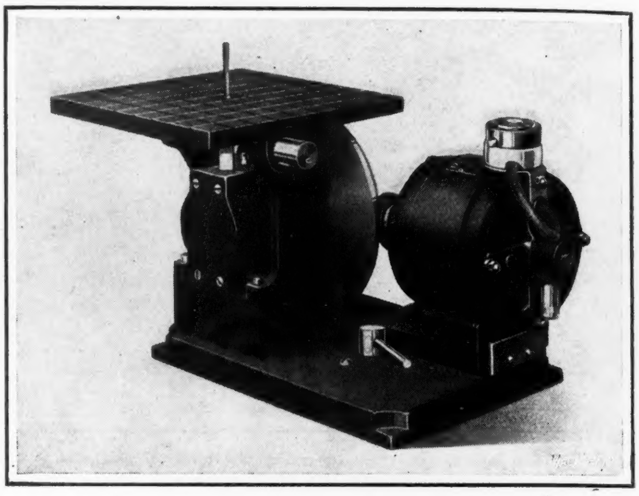
The actual cutting of the metal is done by a small corner of the blades, the reamer cutting from the end like a boring tool instead of scraping the cylinder surface. A micrometer dial facilitates accurate settings of the reamer blades. The reamer may be supported by a rope attached to the top of the shank, which is run over a pulley and provided with a counterweight at the opposite end. By such an arrangement the tool is permitted to feed at the desired rate and will enter the cylinder properly. A ratchet wrench is employed for revolving the reamer in a cylinder bore.

WILMARTH & MORMAN SURFACE GRINDING MACHINE

In November, 1909, MACHINERY was published a description of a No. 1 surface grinding machine developed at that time by the Wilmarth & Morman Co., 1180 Monroe Ave., N. W., Grand Rapids, Mich. This machine has since then been completely redesigned, and is now furnished with an adjustable swivel sub-table, as shown in the accompanying illustration, an improvement which provides a means of conveniently and accurately handling certain grinding operations. It particularly adapts the machine for grinding work of angular or irregular shape, as it is unnecessary to remove the work from the table and reset it in order to procure the proper angle. This is accomplished by swiveling the sub-table which has suitable graduations to enable close adjustments to be made. The sub-table is also provided with T-slots for attaching a headstock and a tailstock, or a dividing head, when grinding work held between centers. The wheel can also be trued without disturbing the work on the table, by means of a built-in truing device permanently located on the wheel hood. The machine is especially recommended for use in accurate gage or die work.



Wilmarth & Morman No. 1 Surface Grinder provided with a Swiveling Sub-table



Motor-driven Die-filing Equipment made by the R. G. Haskins Co.

HASKINS DIE-FILING MACHINE

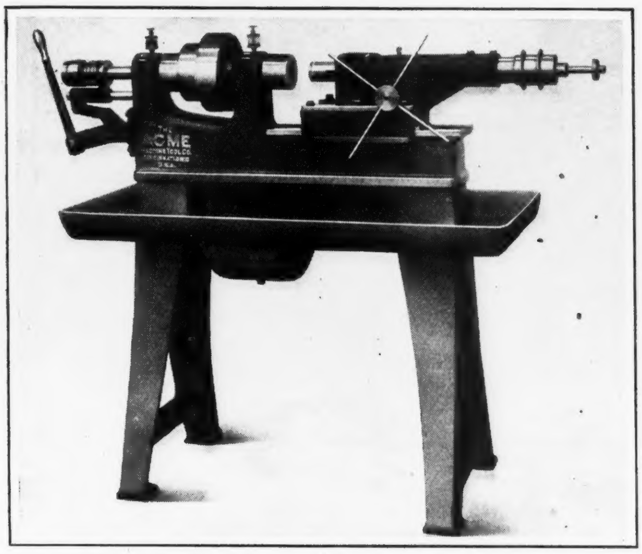
The accompanying illustration shows a motor-driven filing equipment built by the R. G. Haskins Co., 27 S. Desplaines St., Chicago, Ill., which is intended to eliminate the delay and expense of hand filing. The equipment is especially suitable for such work as machining templets, dies, tools, etc. The filing spindle is square in cross-section, and has provision for compensating for wear. Because of the construction it is possible to file sharp corners without play of the spindle. A reciprocating motion is imparted to the spindle by means of a hardened and ground tool-steel block and slide. This mechanism is entirely enclosed and adequately supplied with oil. The table is 9 inches square and may be locked in position for filing at an angle. A series of grooves in the top of the table prevents chips from accumulating on the surface and interfering with the rigid holding of work.

The motor is of 1/4-horsepower capacity, equipped with ball bearings, and is mounted on a dovetail slide. The drive from the motor to the spindle is through a friction wheel and plate. By pushing the motor either forward or backward on its base, the speed of the spindle may be varied from 300 to 700 revolutions per minute. A cam enables the machine to be stopped without stopping the motor. Standard machine files are furnished in sets of twelve, in various shapes and with 1/4-inch diameter shanks. The machine is light in weight, and so can be easily carried from bench to bench. All reciprocating parts are made of tool steel and ground.

ACME HORIZONTAL HIGH-SPEED DRILLING MACHINE

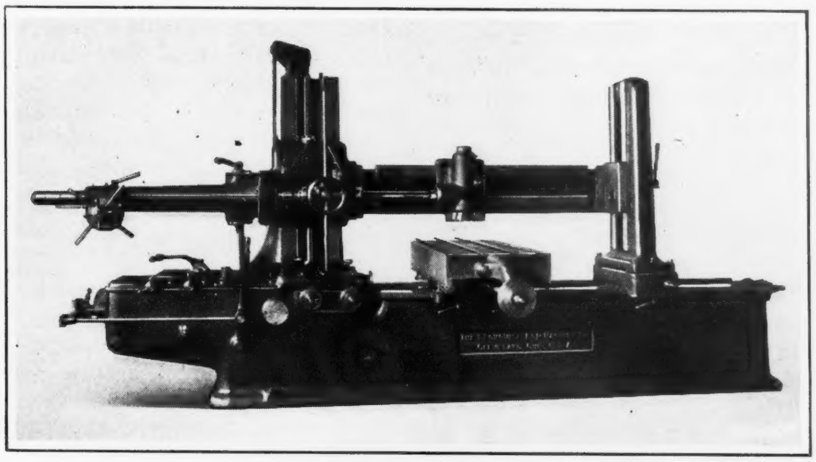
In the accompanying illustration is shown a horizontal high-speed drilling machine recently added to the line of machinery manufactured by the Acme Machine Tool Co., Cincinnati, Ohio. This machine is especially adapted for drilling small-diameter deep holes, such as grease-cup holes in king bolts, or similar work requiring quick operation. The design of the machine in general is similar to a hand screw machine, the spindle and chuck operation being the same as on that type of machine. The work is held in an automatic chuck that is opened and closed by operating a lever located at the head end of the bed.

On a turret-slide saddle is mounted a casting that carries the drill spindle. This arrangement permits the machine to be readily arranged for handling long or short pieces. The spindle is ordinarily run at approximately 3000 revolutions per minute, while the work-spindle is run at 500 revolutions per minute. The spindle is provided at the front end with a No. 1 Morse taper socket for holding drill chucks, and is driven from a flanged pulley on the rear end that is connected by means of a belt to a pulley on a countershaft. The spindle and its driving pulley are equipped with ball



Horizontal High-speed Drilling Machine developed by the Acme Machine Tool Co.

bearings, the bearings for the pulley being mounted on a separate stationary sleeve through which the drill spindle passes. This construction relieves the spindle from all belt pull, and permits it to be operated easily and quickly. The spindle is mounted in a sleeve which has rack teeth that mesh with the teeth of a gear on the turnstile shaft. Operation of the turnstile handle moves the spindle backward or forward, while a stop-collar on the rear end of the spindle may be set to stop the spindle movement when a drill has been fed to the desired depth.



Boring Machine built by the Blomquist-Eck Machine Co., equipped with a Vertical Milling Attachment

BLOMQUIST-ECK MILLING ATTACHMENT FOR BORING MACHINES

A vertical milling attachment, as shown in the accompanying illustration, has been provided for the horizontal boring machines built by the Blomquist-Eck Machine Co., 1146 E. 152nd St., Cleveland, Ohio. This attachment is supported by a cross-rail placed between the horizontal spindle saddle of the machine and the outboard bar support. The vertical spindle saddle of the attachment may be adjusted along the cross-rail by means of a rack and pinion, and is accurately located after placing in the approximate position, by binder screws. Motion is transmitted to the vertical spindle from the regular horizontal spindle by means of bevel gearing in the vertical spindle saddle. On all the boring machines made by the Blomquist-Eck Machine Co. the outboard bar support and the horizontal spindle saddle are machined so that this vertical milling attachment can be applied to any machine whenever desired.

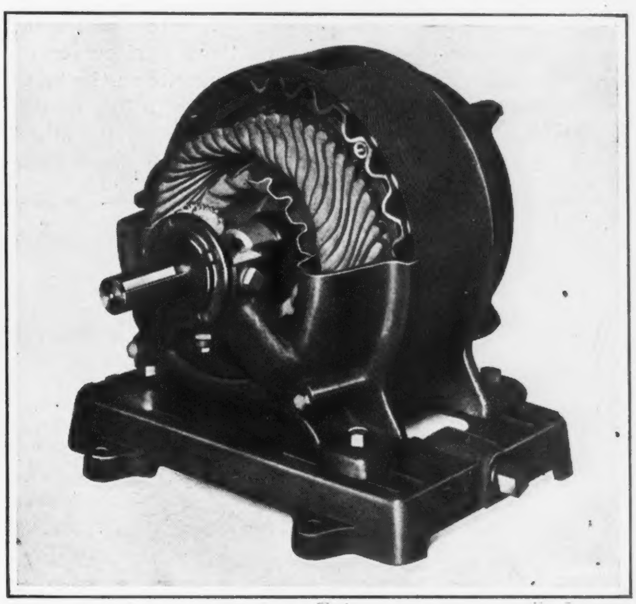
MYERS COMBINATION WORK-BENCH

In August MACHINERY appeared a description of a combination work-bench built by the Myers Machine Tool Corporation, Columbia, Pa., on which was mounted a geared automatic hacksaw provided with a vise, a 10-inch sensitive drilling machine equipped with a table and a ⅜-inch chuck, a grinder head supplied with emery and muslin polishing wheels, and a 4-inch machinist's vise having hardened steel jaws. The entire equipment was driven by a ½-horsepower motor running at 1750 revolutions per minute, which was mounted on a shelf supported by the table legs. A countershaft, mounted on the shelf with the motor, enabled individual or collective use of the different machines. Another work-bench similar to this, but equipped with a 10- by 45-inch engine lathe having a double friction countershaft, instead of the hacksaw, has now been placed on the market by the same concern. The new equipment is known as the No. 2 combination work-bench. The lathe is of standard design having a hollow spindle, power cross-feed, compound rest, thread-cutting mechanism, back-gearing, and three-step cone.

WOODS INDUCTION MOTORS

A line of general-purpose, polyphase, squirrel-cage, induction motors, one of which is here illustrated with one-half a head on one end, is now being introduced to the trade by the S. A. Woods Machine Co., Boston, Mass. These motors are enclosed in all sizes up to one horsepower inclusive, and semi-enclosed in larger sizes. They are ventilated by incoming air, which is screened as it enters the motor. The air then passes through gaps, is guided by a baffle plate over the windings, and exhausted through the bearing heads by the action of a fan. It is said that this system of ventilation insures that the motor will always be dry and free from oil-soaked windings.

The corrugated stator housing gives increased surface area for the radiation of internal heat. All motors have a temperature rise of 40 degrees C. when operated at full load, and the temperature rise does not exceed 50 degrees C. when an overload of 25 per cent is sustained continuously. Lubrication of the bearings is accomplished through the



New Type of Squirrel-cage Induction Motor built by the S. A. Woods Machine Co.

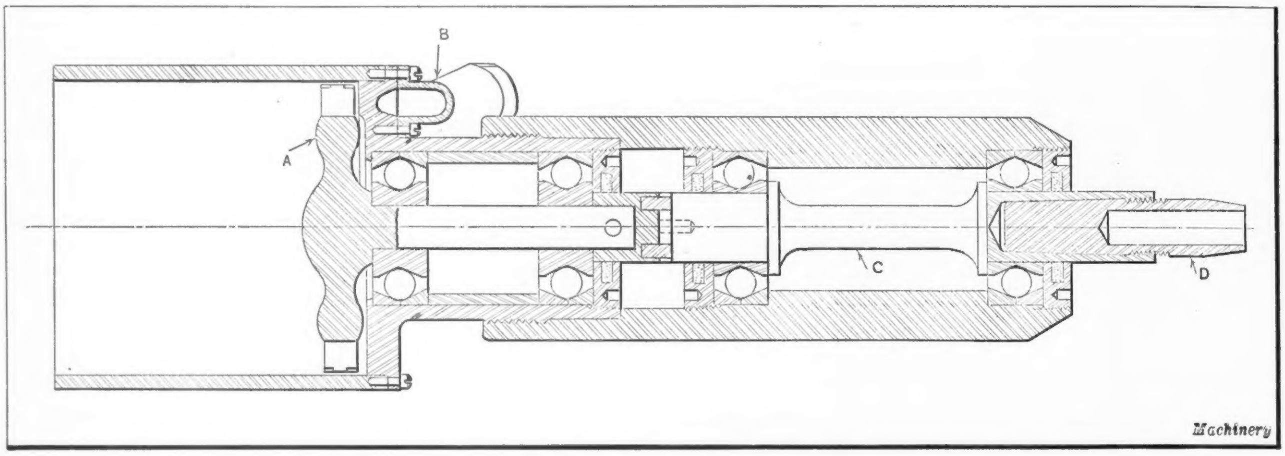


Fig. 1. Air-driven High-speed Grinding Spindle made by the Ex-Cell-O Tool & Mfg. Co.

use of wool waste. The stator windings consist of double cotton-covered enamel wire, while the rotor winding is of the cast unit type. Manufacturers who desire may simply purchase the stator and rotor, and supply their own shaft and bearing heads, enabling the motor to be built as an integral part of their product.

PARKER GRINDING SPINDLES

A high-speed grinding spindle adapted for use on various small-size internal and form grinding machines, and driven by an air motor which gives speeds up to 100,000 revolutions per minute, is shown in Fig. 1. This spindle is a product of the Ex-Cell-O Tool & Mfg. Co., 1214 Beaubien St., Detroit, Mich., sold under the trade name of Parker. It is said that the air drive affords a transmission free from vibration. The air is transmitted to a turbine rotor *A* through two nozzles *B* located diametrically opposite each other. The rotor is constructed of a steel of high tensile strength, and has thirty buckets on its periphery. It has a stem that is connected at the right-hand end to spindle *C*, to the outer end of which a quill *D* is attached. Thus as air is admitted against rotor *A*, it is caused to revolve due to the air being exhausted through its buckets. Air is usually supplied at pressures of from 40 to 60 pounds per square inch, the pressure depending upon the desired speed of rotation. Quill *D* is tapered at its inner end to fit snugly the taper socket in the end of the spindle.

It will be seen that the device is adequately provided with ball bearings. These bearings are of special construction, the outer races consisting of two rings, each of which has a different angle for the surface with which the balls make contact. The angularity of each of these surfaces corresponds with that of the face diagonally opposite on the inner races. In this design, the point of contact of a ball on one race is farther from the axis of rotation than on the other, and this condition causes the balls to revolve about their own axes as well as about the axis of the entire device. The result is a uniform wear of the balls and the elimination of lateral thrust. The angularity of the surfaces of the ball races is such that each ball revolves about its own axis approximately once to every 365 revolutions of the bearing. It is only necessary to oil the bearings every fifty hours of continuous rotation. The construction of the entire unit is such that it can be readily mounted on a machine.

Another grinding spindle intended for internal grinding operations, made by the Ex-Cell-O Tool & Mfg. Co., but which is driven by belt, is shown in Fig. 2. This spindle is equipped with the same type of ball bearings as the air spindle, and both equipments can be furnished to suit any make of grinding machine.

BARR PNEUMATIC DROP-HAMMER

Through a recent improvement in the valve control of the pneumatic high-speed hammer built by H. Edsil Barr, Erie, Pa., which has hitherto been mainly adapted for light forging and tool dressing operations requiring continuous rapid blows, the machine has been made suitable for drop-hammer work in which it is desired to form or straighten pieces completely at one blow. With this improved control, the hammer is always in the raised position when air is turned on. After a piece has been placed on the dies and the foot-lever is depressed, the hammer strikes a quick powerful blow without rebounding, and is returned instantly to the raised position. Rebounding of the hammer is eliminated by admitting air under the piston before a blow is struck. The hammer is also held in the raised position by air, and should the air be accidentally turned off, the ram will slide gently to the bottom position. The stroke of the hammer is 10 inches, and the potential blow, with air supplied at a pressure of 80 pounds per square inch, is about 442 pounds. With an air pressure of 100 pounds per square inch, the blow is about 540 pounds.

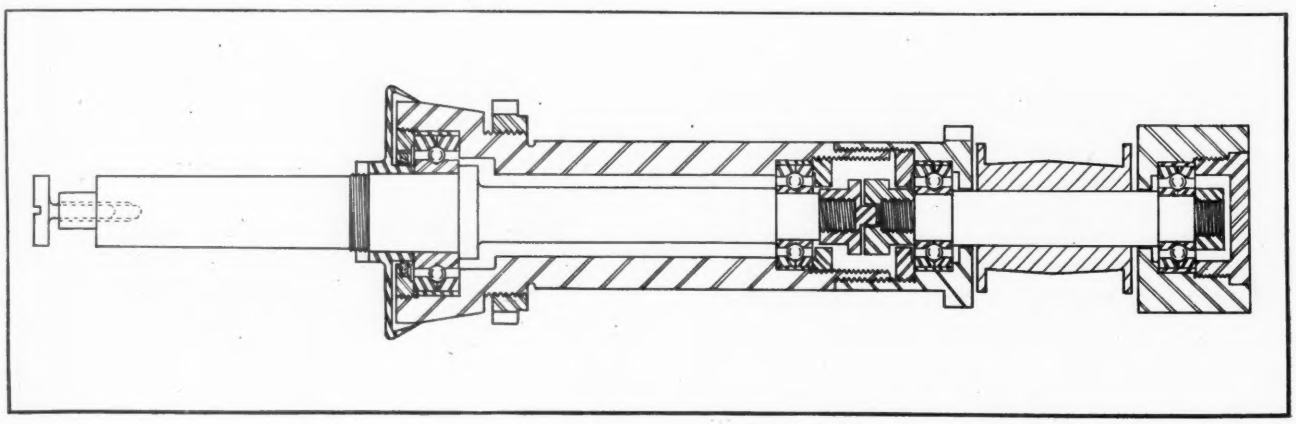
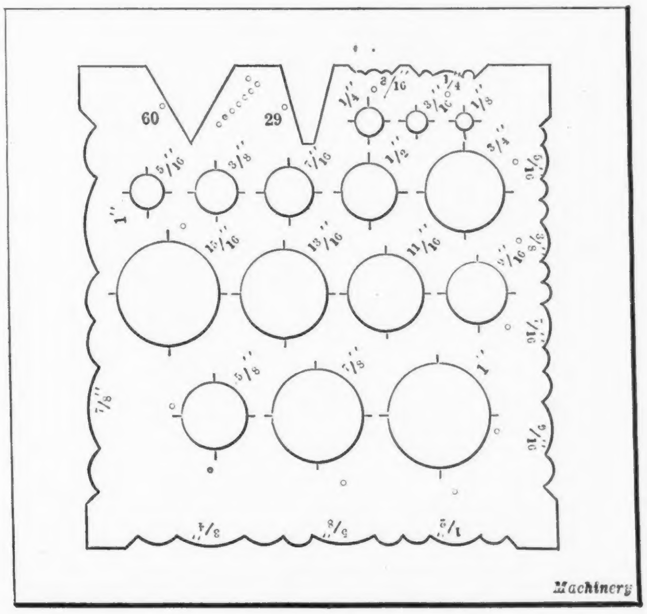


Fig. 2. A Belt-driven Grinding Spindle intended primarily for Internal Grinding

LOPEZ "DRAFTSQUARE"

An instrument intended to simplify the work of draftsmen by making more convenient the drawing of circles, arcs, fillets, nuts, and screw threads has been brought out by the Lopez Mfg. Co., 425 S. Wabash Ave., Chicago, Ill., under the trade name of "Draftsquare." This instrument is transparent, 0.055 inch thick, and 4¾ inches square. Its four edges have a series of arcs in sets of three, each set corresponding to the arcs used in drawing a three-sided view of a nut. The three arcs for any particular nut are identified by the nut size, which is marked on the square for each set. The



Engineers' "Draftsquare" placed on the Market by the Lopez Mfg. Co.

thickness of a nut is determined by marking the drawing through a small hole provided in each case, which is located the proper distance from the top of the arcs.

In drawing 60-degree V-threads, it is only necessary to draw lines representing the outside and root of the thread and then use the sides of a vee cut in one edge of the square for drawing the threads. A second vee facilitates the drawing of Acme threads. Holes ranging from ⅛ to 1 inch in diameter are provided for drawing circles and arcs. A series of holes 1/16 inch apart and a single hole 1/32 inch above these may be used for drawing guide lines for lettering. Angle lines for the same purpose may be quickly drawn by using the sides of the vees provided for drawing screw threads.

BLACK & DECKER PORTABLE DRILL

A new portable electric drill intended for drilling holes up to ¼ inch in diameter in steel has been added to the line of portable drills made by the Black & Decker Mfg. Co., Towson Heights, Baltimore, Md. The drill has an aluminum alloy housing and weighs only 5 pounds. It is of the same general design and construction as other drills made by the same concern, including the pistol grip and trigger switch. Through double reduction gearing the no-load speed is 1600 revolutions per minute. The gears have stub teeth, are made from chrome-nickel steel and heat-treated, and run in oil. All bearings are renewable. The switch mechanism is arranged in the grip in such a way that the tool is particularly adapted for close work, it being possible to drill within an inch of any obstruction.

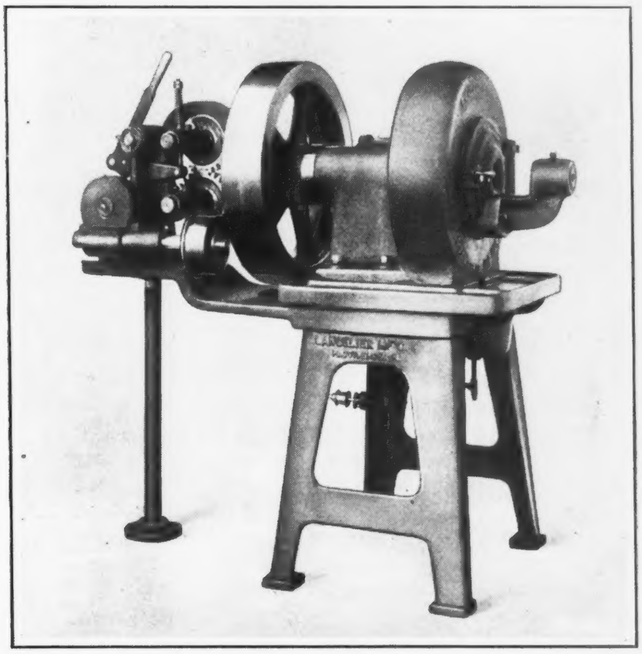
The brushes can be replaced from the outside of the case, and by removing four screws, the commutator, switch mechanism, field leads, and cord terminals may be exposed. The commutator end bearing of the motor armature is carried in a spider that is integral with the motor case. It is thus impossible for the armature to get out of alignment. The commutator may be inspected and cleaned while the drill is running. The drill may also be used for grinding operations, a base, clamp washers, and a grinding wheel being furnished for this purpose. The base can be mounted on a work-bench, and when the device is to be used as a bench grinder, it can be quickly attached to the base and an emery wheel secured to the spindle.

LANGELIER ROLLER-CAGE SWAGING MACHINE

A roller-cage type swaging machine, known as the No. 3½ AT4, is now being built by the Langelier Mfg. Co., Arlington, Cranston, R. I. This machine differs somewhat from the standard machines made by this concern in which the rolls are inserted directly in the head proper, the new type having a hardened steel ring driven into the head, which receives the revolving cage carrying the rolls. Other features of the mechanism are practically the same as on the fixed-roll machines.

The spindle head is slotted for the reception of the hammer blocks, which are bored at their upper ends to accommodate the hammer block rolls. The lower ends of the hammer blocks are slotted to receive the dies. The hammer blocks, rolls and dies are made of a special tool steel, and hardened. A spindle plate screwed to the front end of the spindle retains the different working parts, and limits the opening of the swaging dies during the operation of the machine.

When the machine is operating, as the spindle rotates, the centrifugal force tends to throw the hammer blocks out from their center, thus enabling the dies to open. The head rolls in the revolving cage project toward the center beyond the path of the hammer block rolls, and as they contact, they produce an intermittent rotation of the cage, retarding

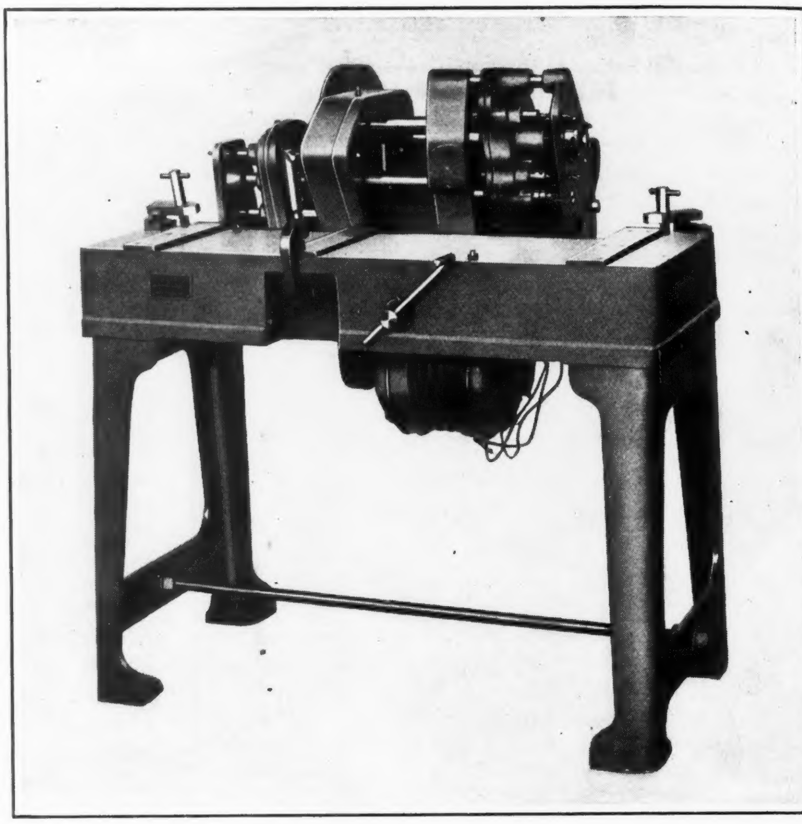


Swaging Machine of the Roller-cage Type which has been developed by the Langelier Mfg. Co.

the blow and resulting in a sliding or squeezing action. This action differs from that on the standard type of machine manufactured by this concern, in which the blow is direct and much more sharp. It is said that slow blows are better adapted to solid work, as more time is given for the stock to flow.

The machine has a roller attachment by means of which the stock is withdrawn after swaging, with a steady and smooth motion that insures a maintenance of the straightness of the work. This attachment is mainly used in light

swaging or sizing work. It can be moved to and from the end of the spindle, over a distance of 5 inches, by means of an adjusting screw beneath the baseplate. The surface speed of the rolls may be changed from 30 to 45 inches per minute. These rolls, with their driving gears, are mounted on crank-arms fulcrumed on the upright casting of the attachment. The lower arm is held stationary by means of a set-screw. The upper roll is pressed against the lower roll by the manipulation of the lever, and tension is maintained by means of an adjustable spring. A bushing on the end of the machine spindle guides the stock into the center of the rolls and prevents it from catching on the gear teeth. The rolls can be opened instantly by means of the lever, and changed quickly by loosening a nut.



Horizontal Machine for drilling and boring Automobile Crankcases, which has been brought out by the Manufacturers' Consulting Engineers

CRANKCASE DRILLING AND BORING MACHINE

A machine that simultaneously drills three holes and bores another for a starter or generator, in each end of an automobile crankcase, is shown in the accompanying illustration. This machine is a recent development of the Manufacturers' Consulting Engineers, McCarthy Bldg., Syracuse, N. Y. It is designed to enable the completion in one operation of work usually accomplished in three operations. The machine consists of a bed supported on legs, on which are mounted a driving motor and two sliding heads. Each head carries three drills and a boring head, although the number can be altered to suit other operations. The heads are fed in opposite directions through the manipulation of a hand-lever, the arrangement being similar to that employed in effecting the feed on sensitive drilling machines.

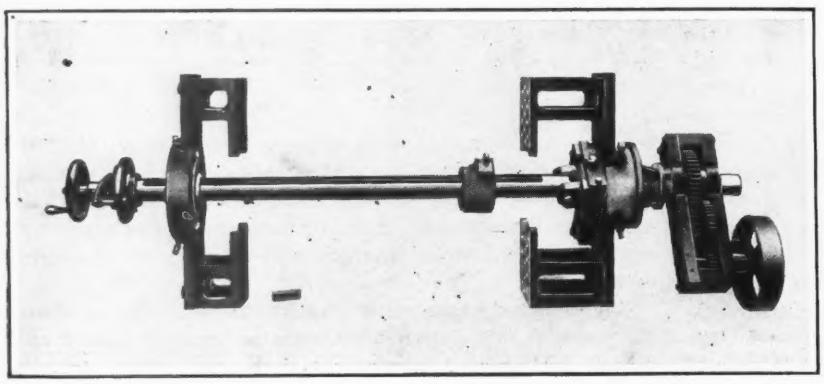
CLEVELAND "MEZZO" TWIST DRILLS

A new line of twist drills which are made from a special steel and given a special heat-treatment to adapt them to drilling conditions under which carbon or high-speed steels do not render satisfactory service, has been introduced on the market by the Cleveland Twist Drill Co., Cleveland, Ohio, under the trade name of "Mezzo." This term was selected to imply that the drills are intended for conditions midway between those under which carbon and high-speed drills are most satisfactory. Many shops, not being properly equipped to obtain maximum results from high-speed drills, are forced to reduce the speed at which they are used, and, if rigidity is lacking, also the rate of feed. These reductions, of course, affect production considerably.

For maximum efficiency, a high-speed drill must be run fast enough to keep it fairly hot, and if the equipment does not allow this, a reduced speed frequently results in breakage. Costly breakage forces many shops without proper equipment to use carbon tools with a subsequent reduced production. Thus it is evident that a saving in expense can be made as well as an increased production obtained in such cases by the use of a drill which will run at speeds and feeds above those of carbon drills and still stand up under the work. The "Mezzo" drills are designed to fulfill these requirements. They are intended for use at approximately double the speeds under which carbon drills work satisfactorily. In order to make them readily distinguishable, the new drills are given a blue-black rust-resisting finish.

PEDRICK PORTABLE TAPER BORING-BAR

A portable boring-bar designed primarily for taper-boring operations, but which may also be used for straight boring and facing, is a recent product of the Pedrick Tool & Machine Co., 3639 N. Lawrence St., Philadelphia, Pa. The special features of the bar are the possibility of taking it to the job and its adjustability to suit any degree of taper. The boring-bar is supported on the part being machined by means of cross-heads having four set-screws that enable the bar to be finally and accurately aligned after it has been roughly centered in the hole to be machined.



Portable Taper Boring-bar made by the Pedrick Tool & Machine Co.

A conical rotation of the bar is produced through a cross-slide and yoke to which the bar is attached. The degree of taper is controlled by the distance that the slide is moved from its central axis. The lower end of the bar, to which the feed-case is attached, describes an orbit and thus necessitates the provision of a spherical-shaped bearing in its cross-head. By preventing the handwheel of the feed-case from turning, the feed becomes constant and automatic. The gearing of this device may be driven by belt, electric motor, or air drill. When a facing arm is used with the boring-bar, the latter is held by spiders inserted in the bore of the work.

PARKER GRINDING, DRILLING AND TURNING MACHINE

Such operations as the grinding of valve reseating tools, valve cages, commutators, and gears, the sharpening of milling cutters, the drilling and regrooving of pistons, the milling of keyways, and other small machine operations can be readily accomplished by the use of a new bench grinding, drilling and turning machine, which has been brought out by the Ex-Cell-O Tool & Mfg. Co., 1214 Beaubien St., Detroit, Mich., under the trade name of Parker. From Fig. 1 it will be seen that the upper or grinding spindle is driven by belt from a ¼-horsepower motor, mounted on the same arm as that which supports the spindle on the column. The grinding spindle can be adjusted to various positions to suit angular operations, the motor swiveling with the head. The motor can be furnished to run from any lighting current. A small lever on the right of the grinding spindle head is employed for reciprocating the grinding wheel back and forth across the work.

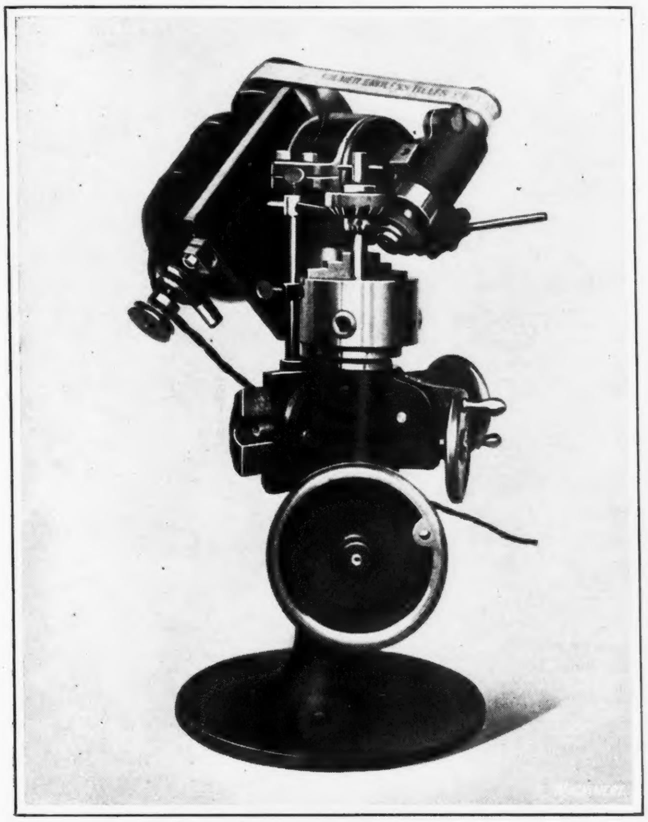


Fig. 1. Grinding, Drilling and Turning Machine placed on the Market by the Ex-Cell-O Tool & Mfg. Co.

Fig. 2. Machine set up for Drilling Operation, the Work-spindle being at an Angle and the Upper Spindle Vertical

The lower spindle, or work-spindle, is shown equipped with a 4-inch universal scroll chuck, but a 6-inch faceplate is also provided. The work-spindle may also be swiveled to any desired angle, as will be apparent by referring to Fig. 2, in which the upper spindle is in a vertical position and provided with a chuck and drill for drilling holes at an angle through the wall of an automobile piston. Both the swiveling members of the upper and lower spindle heads are graduated to enable accurate adjustments. In Fig. 2 it will also be seen that a large pulley has been mounted on the upper spindle instead of the small pulley seen in Fig. 1. A larger pulley is necessary in drilling and milling operations for reducing the speed of the spindle to suit these classes of operations. The lower spindle may also be revolved by a handwheel which is driven by a V-shaped belt, the handwheel being provided with a groove around its periphery for this purpose. This V-shaped belt is connected to the small pulley mounted on the shaft extending from the lower end of the motor, previously referred to in connection with Fig. 1. The proper tension is maintained on this driving belt by means of a double idler pulley fastened to a spring on an adjustable rod secured to the motor support. This arrangement is not illustrated.

The upper spindle is equipped with ball bearings, while the work-spindle has a straight bearing which extends its full length and also has a ½-inch 45-degree angle thrust bearing. Both external and internal grinding operations can be performed on the machine, and an idea of its grinding range can be obtained from the fact that it is used for grinding the outside cylindrical surfaces of automobile pistons and for grinding holes as small as 5/16 inch in diameter. The regrooving of pistons and the turning of small armatures can be accomplished by mounting a tool in the lug at the left of the grinding spindle bearing. An overhanging center bracket can be furnished. The lower spindle head has a horizontal travel of 7 inches and a vertical movement of 8¾ inches. The machine has an over-all height of 24 inches, and weighs about 135 pounds.

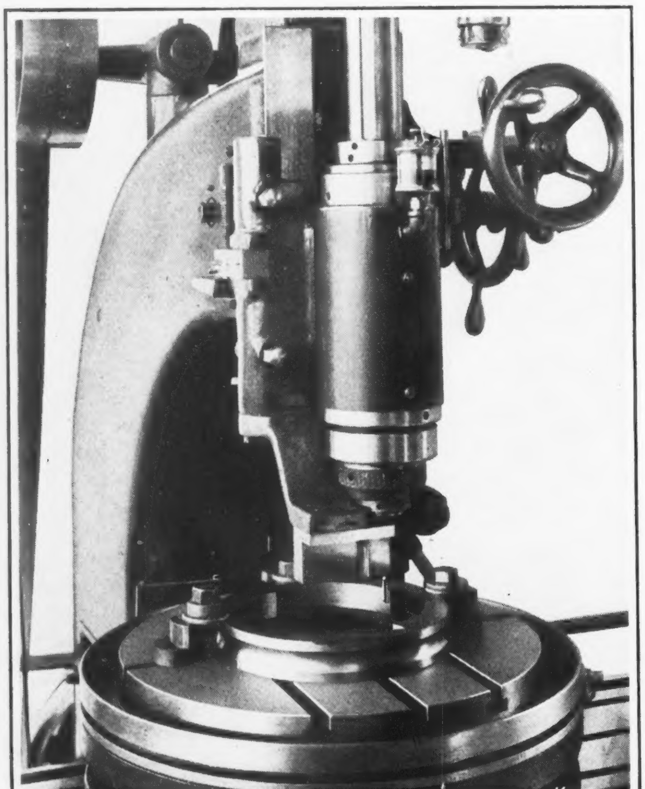
TURNER GASOLINE-KEROSENE BLOW-TORCH

The Turner Brass Works, Sycamore, Ill., have recently brought out a new style blow-torch using either gasoline or kerosene for fuel. On this torch the shut-off valve is located below the orifice. This construction prevents enlarging of the orifice through shutting off tightly when hot by forcing the point of the needle in, or through fuel corroding the needle point when the torch is cool. An adjusting needle in the orifice permits all gases to escape. It can be regulated so as to obtain any size flame without destroying the orifice. A cone-shaped tube on the burner siphons the correct amount of air regardless of the adjustment. The feed-tube is placed on the outside of the tank so as to prevent any possibility of heating the fuel in the tank to such a degree that it would create gas pressure and cause an explosion. The leather on the plunger of the air pump is loose in the cylinder, decreasing wear and allowing air to pass freely on the upward stroke. On the downward stroke the leather flares out and forces a large volume of air into the tank.

BECKER MILLING MACHINE ARRANGED FOR HIGH SPINDLE SPEEDS

Light milling operations must sometimes be performed on work so large as to require a large size machine having a large table space and throat clearance, when a much smaller machine would be preferable because of the higher spindle speeds obtainable with small cutters. To meet such requirements the Becker Milling Machine Co., 677 Cambridge St., Worcester, Mass., has arranged its No. 5-C vertical milling machine so that on special order, spindle speeds up to 1400 revolutions per minute may be obtained and cutters as small as 7/32 inch in diameter successfully used. The normal range of speeds for this machine is from 13 to 500 revolutions per minute. The high speeds do not interfere with the regular speeds, so that the machine may be used for all usual jobs and also be promptly available for high-speed work.

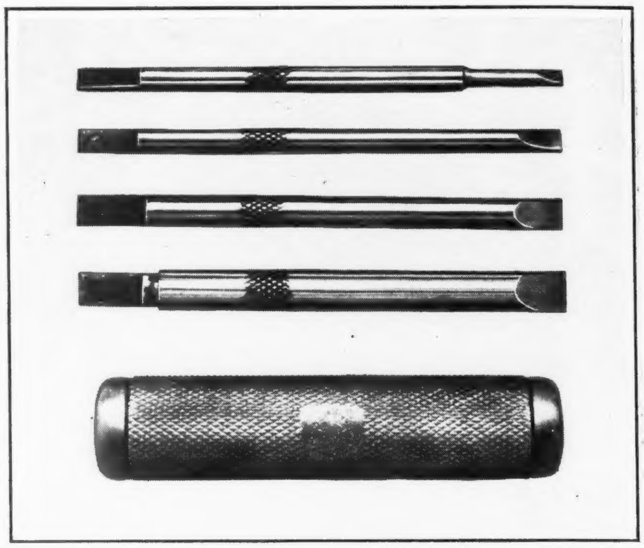
A special three-speed countershaft, with one shipper for obtaining the regular speeds and another for the high speeds, is employed. In the job shown in the illustration a groove 7/32 inch wide and 1/4 inch deep is milled tangent to the circular wall previously milled and about 1 inch below the top face of the work. Because of the necessary extension from the spindle face of the frail cutter employed for the operation, a special bracket is bolted to the spindle head, to which is attached a bushing which supports the cutter close to the surface being milled. This particular job does not require a large throat clearance, the machine set-up being primarily intended for other sizes of work which necessitate the use of a large machine.



Operation performed on the No. 5-C Vertical Milling Machine built by the Becker Milling Machine Co.

CONSOLIDATED SCREWDRIVER SET

A screwdriver set consisting of one handle and four blades, any of which may be inserted in the handle to suit the slot in the head of the particular screw that it may be desired to drive into place or remove, is now being placed on the market by the Consolidated Tool Works, Inc., 296 Broadway, New York City. Two blades of the set fit into one end of the handle, and the other two into the opposite end. The blades are made of tool steel, ground and tempered, while the handle is turned from cold-rolled steel and knurled. The ends of the blades are 1/8, 3/16, 1/4, and 5/16 inch wide, respectively, and the length is 3 1/8 inches. When a blade is inserted into a handle, the over-all length of the screwdriver is about 6 1/2 inches. The blades are held in a positive manner in the handle and may be quickly interchanged.

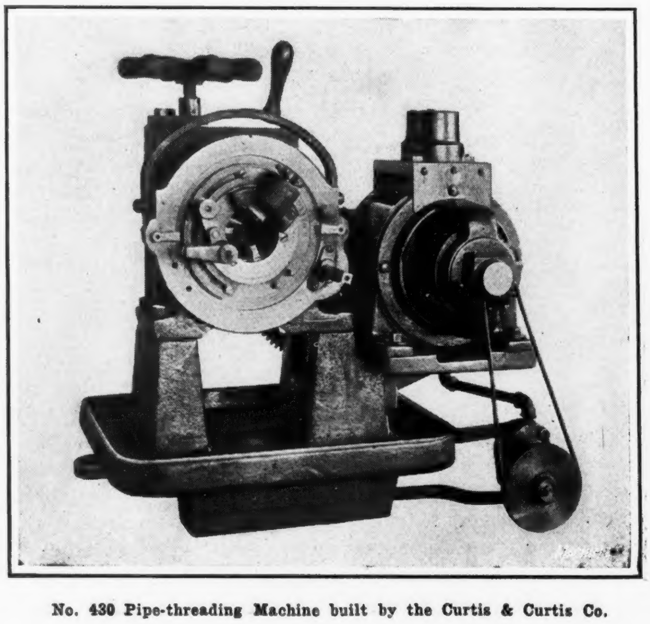


Four-blade Screwdriver Set placed on the Market by the Consolidated Tool Works, Inc.

CURTIS MOTOR-DRIVEN PIPE-THREADING MACHINE

A No. 430 motor-driven pipe-threading machine has been designed by the Curtis & Curtis Co., 324 Garden St., Bridgeport, Conn., to meet the requirements for a portable outfit equally adaptable for use in the shop or in the field. The pipe is held stationary in a vise which forms part of the machine, and the dies, which are contained in a die-head, are screwed on the pipe, power being supplied by the motor through rawhide, steel, and cast-iron reduction gears.

The die-head is equipped with an automatic release which opens the dies at the completion of a threading operation while the machine is still running, so that the pipe may be removed without backing off the thread or stopping the machine. By turning a small lever, the dies are reset and the machine made ready for the next cut, which is identical with the preceding one, both as regards the length and diam-



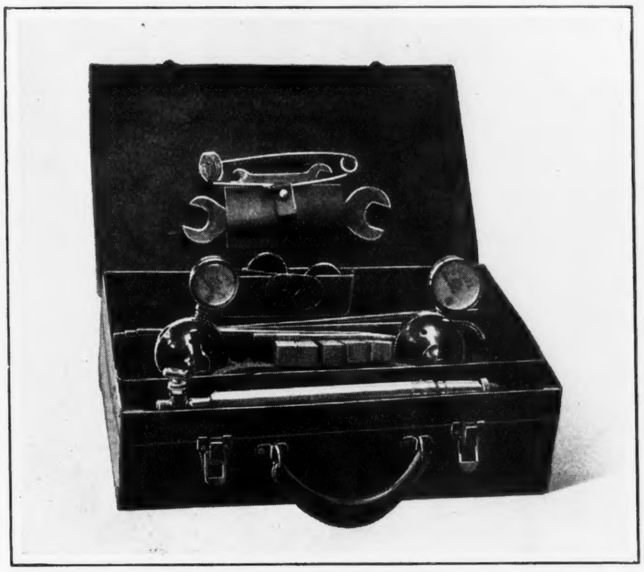
No. 430 Pipe-threading Machine built by the Curtis & Curtis Co.

eter of the thread. The die release is adjustable to enable either long or short threads to be cut. The machine is equipped with a cutting-off attachment that cuts the pipe square without leaving a burr. High-speed steel tools and an oiling system with a pump are furnished with each outfit. The rating of the motor is 1 horsepower, and it may be run on ordinary lighting current. The machine, complete, weighs approximately 350 pounds.

DAVIS-BOURNONVILLE WELDING OUTFIT

A welding outfit contained in a substantial fiber case to facilitate transporting it to a job, which is said to be suitable for any welding operation, is shown in the accompanying illustration. This outfit has recently been brought out by the Davis-Bournonville Co., Jersey City, N. J., and includes a torch, three extension tubes, five welding tips, decarbonizing tube, oxygen regulator, acetylene regulator, 12 feet of oxygen hose and connections, 12 feet of acetylene hose and connections, spark lighter, pair of colored glasses, and torch and regulator wrenches.

The gas tubes are silver-soldered into both the head and rear ends of the torch. The needle valves are quick-opening,



Welding Outfit placed on the Market by the Davis-Bournonville Co.

and are also silver-soldered in place. The mixing chamber in the head end of the torch is so constructed that the gases are correctly mixed before entering the tips. Some sizes of the tips are made of copper and others of brass. The tip nut is made with a fine thread on the inside to fit the brass sleeve, and threaded on the outside to fit the head of the torch. Thus the tip can be made gas-tight in the head by hand pressure alone. Numbers are stamped on the handle of the torch showing the pressures of acetylene for use with the various sizes of tips in order to give a strong welding flame. The copper extension tubes can be furnished in any length desired. The tubes are flexible so that it is possible to weld in places otherwise inaccessible.

COATS-LEONARD RENEWABLE PLUG GAGES

Plug gages on which the gaging ends are renewable to make replacements possible at a minimum cost are now being placed on the market by the Coats Machine Tool Co., Inc., 110-112 W. 40th St., New York City. The gages are made of hardened steel and are ground within an accuracy of 0.0001 inch. They are put up in two sets in wooden cases. The No. 1 set comprises fourteen sizes from 1/4 to 1 1/4 inches in diameter, the sizes increasing by increments of 1/16 inch

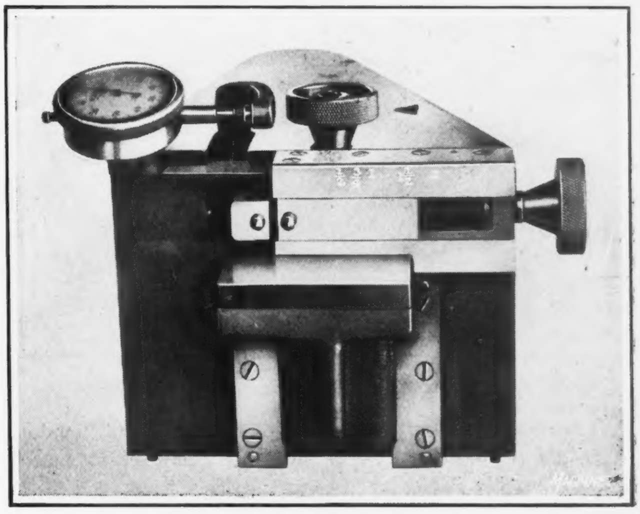
Case of Renewable Plug Gages placed on the Market by the Coats Machine Tool Co., Inc.

up to 1 inch, and by 1/8 inch increments from 1 to 1 1/4 inches. Any special combination of sizes can be supplied to order. The four smaller sizes are made solid with the handle. The No. 2 set comprises sizes from 1 3/8 to 2 1/4 inches in diameter, increasing by increments of 1/8 inch. Renewable limit plug gages are also supplied by the same concern to meet the demand for limit gages which can be furnished from stock. Each gage consists essentially of three parts, a "Go" end, a "Not Go" end, and a handle. The handles are interchangeable, and one size will fit a range of plug sizes. Stocks of hardened ends in both English and metric measurements are always carried on hand.

TOLEDO THREAD-LEAD GAGE

Imperfect lead of threads is largely responsible for the loose fit of screws in machines, because if the lead is inaccurate only two or three threads of the screw may bear against the threads of the tapped hole which the screw engages, with the result that when the members held together are stressed, the screw stretches a sufficient amount to produce a loose fit. In order to check closely the lead of all taps and accurately machined studs, the Toledo Tap & Die Co., Clinton St., Toledo, Ohio, designed the lead gage here illustrated, and has now placed it on the market. By means of this device on which patents are pending, the lead of threads can be quickly checked.

This gage has an arm 8 inches long that is pivoted on adjustable angle bearings and carries at its outer end a hardened and ground conical point. The arm also has a hardened button which comes in contact with the plunger of

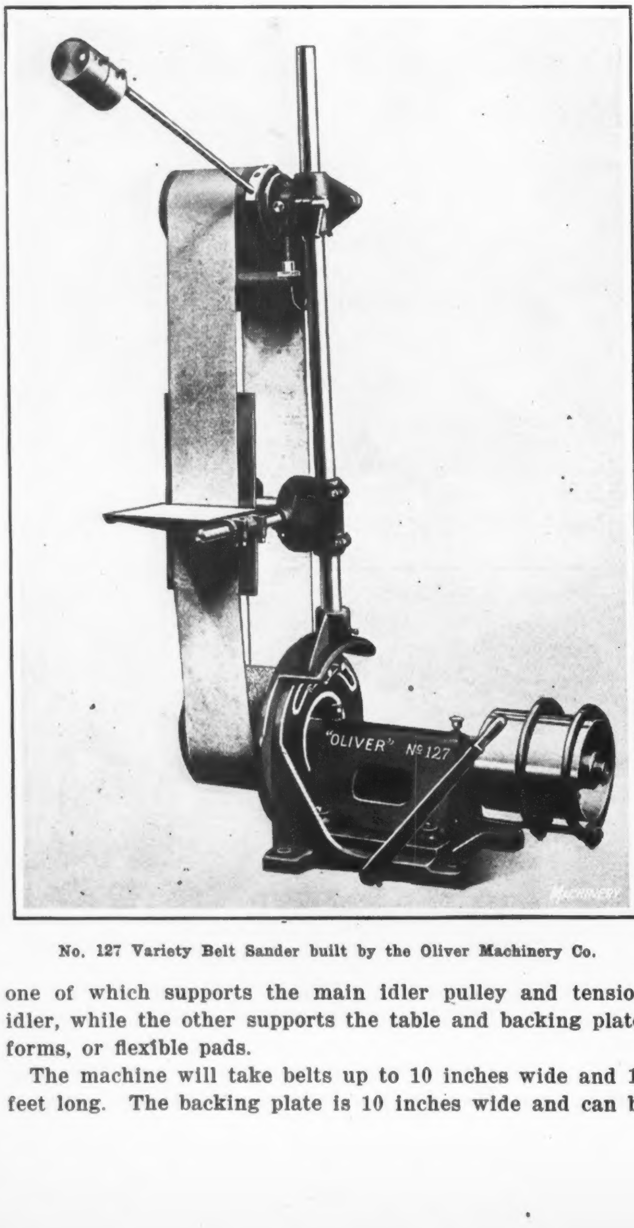


Gage for checking Lead of Threads, which has been developed by the Toledo Tap & Die Co.

the dial gage and registers, positively, any variations between a master thread gage and the work being inspected. There is a second hardened and ground conical point mounted on a slide which may be operated horizontally, so as to vary the distance between this point and that on the pivoted arm. The distance between the two points may be varied from ½ to 2 inches. In employing the device, a master gage is first laid on the table after the latter has been elevated until the center line of the gage coincides with the conical points. Then the latter are made to engage with two threads of the gage the desired distance apart, and the slide is adjusted until the dial indicator registers zero. The threads of work to be tested are then pressed firmly against the conical points and any difference in lead from the master setting will be indicated accurately on the dial. The dial may be furnished to show variations of either 0.001 or 0.0001 inch. The arm and pivot points are fully enclosed so that they cannot be tampered with.

OLIVER NO. 127 BELT SANDER

The No. 127 variety belt sander here illustrated is now being built by the Oliver Machinery Co., Grand Rapids, Mich., for pattern shop use. It is suitable for sanding concave and convex surfaces and the various irregular shapes met with in the manufacture of patterns, performing work usually done on disk and drum sanders. The table may be tilted to suit angular surfaces or draft on work. The machine is driven from a pulley mounted on a countershaft located on the base. On this base is mounted a frame that swings about the center of the countershaft and carries a supporting arm. On the latter are mounted two brackets,



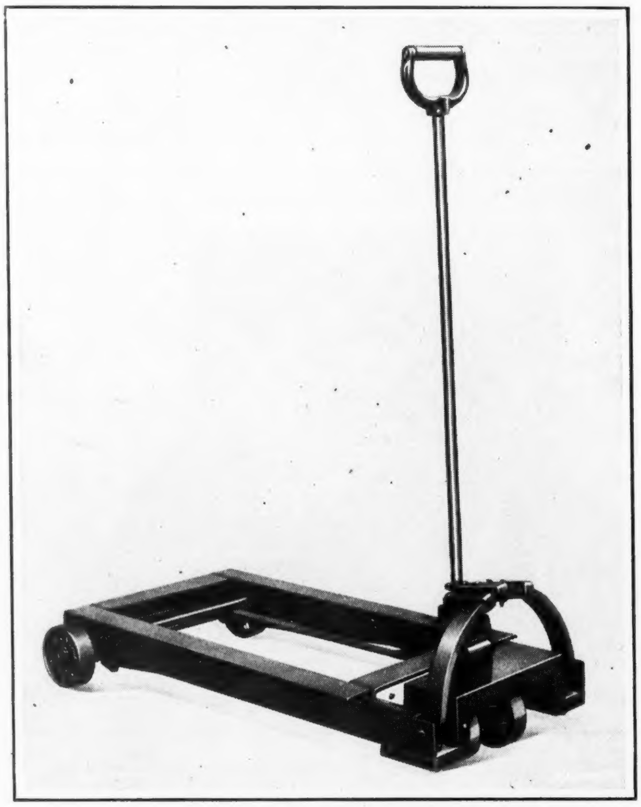
No. 127 Variety Belt Sander built by the Oliver Machinery Co.

one of which supports the main idler pulley and tension idler, while the other supports the table and backing plate, forms, or flexible pads.

The machine will take belts up to 10 inches wide and 14 feet long. The backing plate is 10 inches wide and can be adjusted in and out to produce a suitable tension on the belt. It has holes drilled in it for attaching flexible pads. The main idler is leather-faced and adjustable up and down the entire length of the idler arm to suit different lengths of belts. The tension idler is also faced with leather; it fulcrums on the center of the main idler, and is balanced by weights to give the correct tension to the belt. A fork idler may be mounted on the machine in place of the table, for doing oval sanding. This machine may also be motor-driven, in which case a motor of two-horsepower capacity is provided.

WESTERN LIFT TRUCK

The "Champion" lift truck here illustrated is a product of the Western Tool & Mfg. Co., Springfield, Ohio. This truck is constructed entirely of iron and steel parts, many of which are hand-forged. The front wheels swivel on thrust

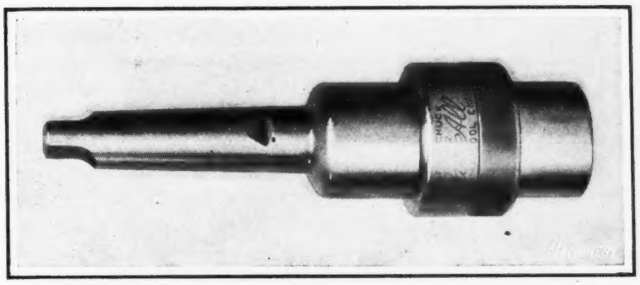


Steel Lift Truck made by the Western Tool & Mfg. Co.

ball bearings, and all wheels are provided with cage roller bearings. Weights up to 2000 pounds can be raised easily by one man. The truck turns in its own length. The over-all length is 46 inches and the over-all width 26 inches. The platform dimensions are regularly 23 by 38 inches, but platforms may also be supplied in any other lengths desired. The truck will raise a load through a distance of 1½ inches.

"SAVE-ALL" QUICK-CHANGE DRILL CHUCK

A positive safety quick-change chuck for drills or other tools with taper shanks is now being placed on the market by the Save-All Tool Co., 59 River St., Waltham, Mass. The drill or other tool is held in a collet which may be slipped into the chuck when the sleeve on the latter is raised. By lowering this sleeve, jaws are made to engage the taper end of the collet and hold it in place. This chuck has a device which prevents the breaking and burning of tools by shearing a pin that drives the collet whenever the cutting tool is overloaded. This pin is held in place by a pointed screw which seats in a groove in the pin, and, after a pin has been sheared, it can readily be removed by loosening the screw.

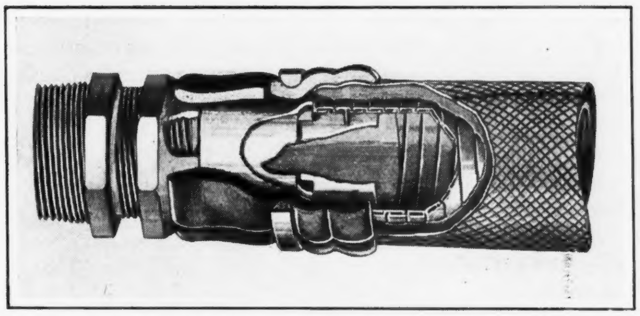


Safety Quick-change Drill Chuck made by the Save-All Tool Co.

The construction of the collet and chuck body is such that the members do not stick when tools are changed. A compensating collet lock automatically takes up wear and eliminates end motion, while a "Bristo" hollow set-screw prevents the tool from pulling out. Tools can be changed while the machine is in motion. The release of a tool from the collet is effected by striking a light blow on an ejector in the small end of the collet. The chuck illustrated accommodates drills having Nos. 1, 2, 3, and 4 Morse taper shanks. All parts are hardened, except the shearing pin.

"KNORR" DETACHABLE COUPLING

The "Knorr" metal coupling, which is readily detachable, leak-proof, and suitable for hose used with pneumatic tools, is placed on the market by the Barlow Mfg. Co., 108-114 Park Place, New York City. This coupling is also suitable for hose employed in conveying gasoline, etc., and is capable of withstanding pressures of over 450 pounds per square inch. Three or more arms of stamped steel closely embrace the end of the hose of any given outside diameter, these

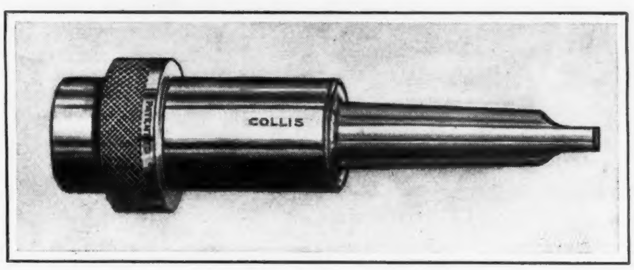


Coupling for Metal-lined Hose which is placed on the Market by the Barlow Mfg. Co.

arms being held in place by a steel ring. The arms are made to grip the hose through a wedge or spreader-nut threaded on the shank of the coupling, which forces out the arms at the other end. This lever combination enables the user to exert an easily adjusted pressure upon the hose and to remove the latter quickly by revolving the spreader-nut several times. Slight variations in the thickness of hose do not interfere with the attachment of the coupling. The shank or body is thin at the hose end and threaded, so that it can be screwed into the interior lining of the hose.

COLLIS QUICK-CHANGE DRILL CHUCK

The "Wonder" quick-change drill chuck here illustrated has been designed by the Collis Co., Clinton, Iowa, for use in the spindle of lathes, drilling machines, screw machines,



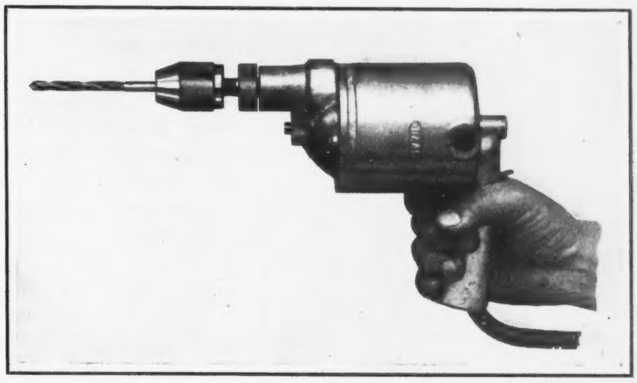
"Wonder" Quick-change Drill Chuck manufactured by the Collis Co.

and other machines having rapidly rotating spindles. The chuck can be operated by one hand, and collets inserted or released while it is revolving at speeds up to 1500 revolutions per minute. The ease with which a tool can be replaced adapts the chuck for use in the performance of several operations without removing the work.

The collets have taper shanks and may be used either in a horizontal or a vertical position. By the use of different collets either taper or straight shank drills and hand taps can be accommodated. A special style of collet known as the "Use-Em-Up" enables drills with twisted or broken shanks to be used, it being only necessary to grind a flat on the remaining portion of the shank. The chuck is made in six sizes.

"CYCLONE" ELECTRIC DRILL

A small portable electric drill having a capacity for drilling holes up to 5/16 inch in diameter in metal, has been brought out by the United States Electrical Tool Co., 6th Ave. and Mt. Hope St., Cincinnati, Ohio. This drill has an aluminum alloy housing, weighs about 5½ pounds, and has an over-all length of 9 inches. The gears are made of chrome-nickel steel, and are hardened and run in grease. The electric switch is located in the handle so as to be con-

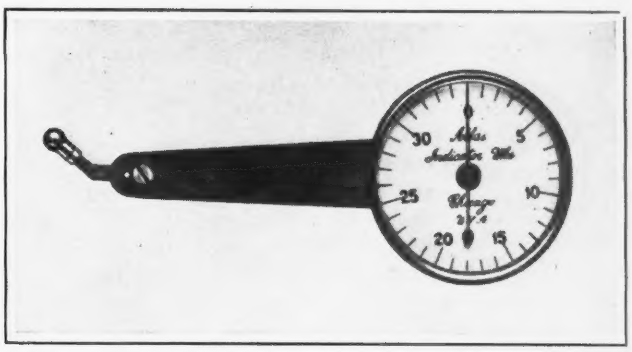


Portable Electric Drill manufactured by the United States Electrical Tool Co.

veniently controlled by the thumb at all times. The motor is of the universal type, air-cooled, and wound for operation by 110- or 220-volt current. It operates on from 25- to 60-cycle, single-phase, alternating current or direct current, and may be attached to any lamp socket. This drill is especially suitable for corner drilling, as it may be used within ¾ inch of walls.

ATLAS DIAL INDICATOR

A small indicator reading over a range of 0.055 inch, known as the "Junior," is being sold by the Atlas Indicator Works, 160 N. Wells St., Chicago, Ill. The indicator dial



"Junior" Indicator made by the Atlas Indicator Works

is carried on a swivel mounting that offers a convenient means of attaching the instrument to suit the various jobs on which it may be employed. After adjusting the contact point on the work, the dial may be revolved so as to bring the

zero mark in line with the indicator hand. The reading of the indicator may be magnified or diminished by adjusting its contact point, this feature being of value when the instrument is employed by inspectors to detect the presence of errors on work, but not to measure their magnitude. The contact point may be locked in any desired position by means of a threaded collar on which patents are pending.

BLACK & DECKER CLEANING MACHINE

An equipment designed for cleaning small parts such as ball and roller bearings, gears, motor and generator parts, drills, milling cutters, and other tools has been produced by the Black & Decker Mfg. Co., Towson Heights, Baltimore, Md. The device consists of a cast-iron pedestal at the top of which a bowl is mounted. This bowl is 13 inches in diameter, 12 inches deep, and has a fine-mesh brass screen supported at about 5 inches from the bottom. The housing of a plunger pump is cast integral with the bowl. The latter has a safety cover so arranged that it cannot be left open. The cover is lifted by means of a convenient handle that operates the pump each time the cover is raised. A gallon of gasoline, kerosene, or other desirable liquid cleanser is poured into the bowl of the machine and the operation of the pump forces a stream of this fluid toward the center of the bowl from one side. The part to be cleaned is held under the stream of cleansing fluid so that dirt and chips are washed from the part and deposited on the screen below, the fluid passing through the screen and returning to the sump to be used again.

Apparatus for cleaning Small Work, made by the Black & Decker Mfg. Co.

SHEPARD ELECTRIC HOIST

A new electric hoist known as the "Liftabout," which is manufactured by the Shepard Electric Crane & Hoist Co., Montour Falls, N. Y., is shown in the accompanying illustration. The motor furnished with this equipment is of the fully enclosed type, with interchangeable frames for direct and alternating current. The motor is especially designed for hoist service and carefully insulated and impregnated to protect it from moisture. A standard series-wound interpole motor is furnished for direct current, and when the motor is running without load, its speed is approximately twice its full-load speed. The hoisting speed with an empty hook is, therefore, about twice that of the full-load speed. The induction motor furnished for alternating current may be of either the squirrel-cage or slip-ring type, the squirrel-cage motor being used with a single-speed control and the slip-ring type with a variable-speed control.

Either variable- or single-speed controllers are furnished, depending on the service in which the hoist is to be employed. The variable-speed control for direct current offers

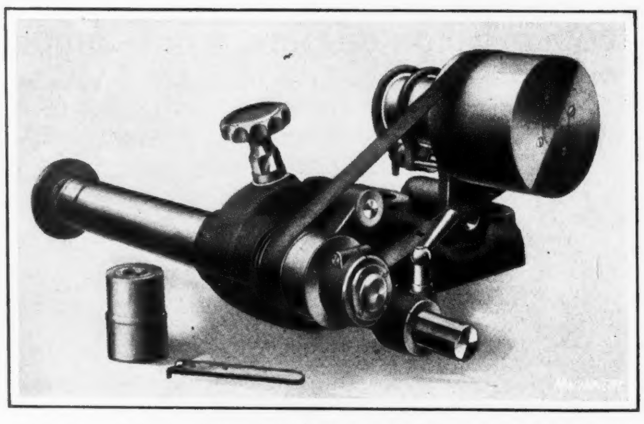
New Electric Hoist manufactured by the Shepard Electric Crane & Hoist Co.

eleven or thirteen running speeds, the number of speeds depending upon the size of the motor. Eight running speeds are possible with alternating current. The operating parts of the controller are fully enclosed from dust and moisture, but are readily accessible. The entire mechanism including the resistance may be removed from its case without disconnecting a single wire, and, likewise, the contacts and brushes may be removed without disturbing other parts of the controller. A single-speed control is afforded through a switch, the only function of which is to start, stop, and reverse the hoist mechanism. The hoist gearing consists of a double train of spur gears having either two or three speed reductions.

A mechanical brake of the multiple disk type automatically holds the load when the motor is at rest, and prevents excessive speed in lowering, while an electric brake, also of the multiple disk type, brings the motor promptly to rest when the current is cut off or accidentally interrupted. An automatic limit switch prevents over-running of the load hook.

"FORTUNA" GRINDING SPINDLES

A line of spindles known as "Fortuna" designed especially for use in shops in which no grinding machine is installed has been placed on the market by the Coats Machine Tool Co., Inc., 110-112 W. 40th St., New York City. This line consists of a spindle intended for internal grinding, a second spindle for both face and internal grinding, and a third for vertical internal and face grinding. The spindles may be driven from a pulley similar to that illustrated, or by means

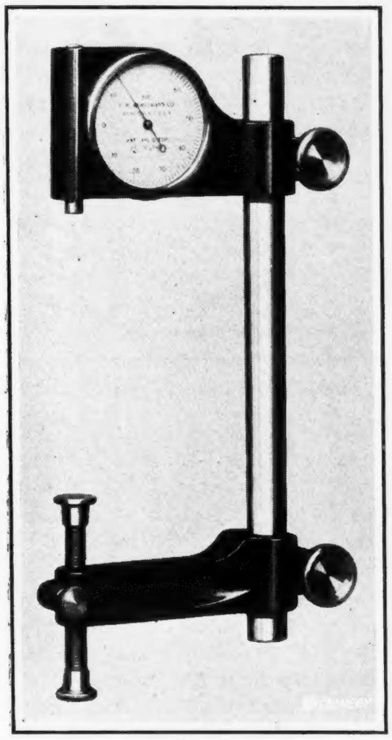


Internal- and Face-grinding Spindle placed on the Market by the Coats Machine Tool Co., Inc.

of a motor mounted on the clamping block. This block may be attached on the slide of a machine for feeding the grinding wheel across the work, it being especially suitable for use in connection with a lathe. The spindles are equipped with "Norma" ball bearings, and all attachments are readily interchangeable. The clamping block permits a quick reversing of the countershaft or the motor so as to enable work to be revolved to the left as readily as to the right. The construction of the attachment permits grinding wheels to be run at their maximum speeds.

HORSTMANN INDICATING CALIPER

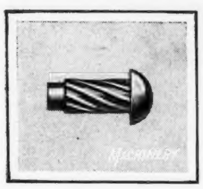
The extension-beam indicating caliper shown herewith is a modification of the indicating caliper placed on the market several years ago by the F. W. Horstmann Co., 196-210 Coit St., Irvington, N. J. The rear surfaces on the arms of the new instrument are machined flat, so that it may be used while lying on a flat surface. The device is employed for ascertaining the exact amount that work varies from a desired size. It is set by placing a piece of the desired length between the plunger of the indicator and the adjusting screw, and advancing the screw until the pointer of the indicator registers zero. Variation in the length of pieces can then be observed by noting the amount that the indicator pointer moves from the zero mark when pieces are placed between the screw head and the plunger. The distance between internal surfaces may be measured by reversing the arms on the beam. The beam is 6 inches long and ½ inch in diameter, but any necessary length can be substituted. Two of the classes of work for which the instrument is especially valuable are gaging across the face of large-diameter work in a lathe, or across wide pieces being machined on a planer.



Indicating Caliper made by the F. W. Horstmann Co.

PARKER NAMEPLATE "DRIVE-SCREW"

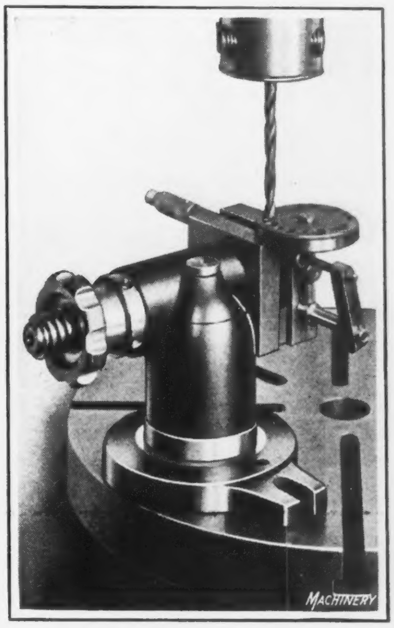
The "drive-screw" shown in the accompanying illustration was designed to present an easy and inexpensive method of permanently attaching nameplates, trademark plates, etc., to machine tools. The screw has a round head which is not slotted, threads of a very coarse lead, and a cylindrical pilot. In attaching a plate, holes slightly larger in diameter than the screw pilot are drilled into the part to which the plate is to be attached, and the screws are driven into place with a hammer. Owing to the fact that the screws are hardened and heat-treated, the threads readily cut their way into iron castings, and as the heads are not slotted, the screws cannot be easily removed in order to substitute another nameplate. This nameplate "drive-screw" is made by the Parker Supply Co., Inc., 793 E. 135th St., New York City.



Parker Nameplate Drive-screw

W. B. U. COMBINATION VISE, DRILL JIG AND MILLING FIXTURE

The W. B. U. Tool Co., 104 Harding St., Worcester, Mass., has recently brought out the combination vise, drill jig, and milling fixture here illustrated, which has been designed to hold work with accuracy. The vise is adapted for holding work on which two or more cuts are to be taken at different angles, and such operations can be accomplished without resetting the work. Both the jaw and swivel base are graduated through 360 degrees to facilitate angular settings. The equipment is especially suitable for use on machines where work can be tested with a square, directly from the work-table.



Combination Vise, Drill Jig, and Milling Fixture made by the W.B.U. Tool Co.

Part of the equipment is a solid drill bushing plate having eighteen holes ranging from 7/64 to ⅜ inch in diameter. The vise may be set for the drilling of round stock from 5/16 to 1 inch in diameter, which is held in a vee. By reversing the bushing plate, flat or square stock can also be drilled. The device is quickly adjusted by turning the screw. In filing work held in the vise, it is unnecessary for a toolmaker to remove the work frequently in order to ascertain whether it is being filed square.

COPPUS SCREW-BLADE PROPELLER BLOWER

A screw-blade propeller blower suitable for a variety of applications is being sold under the trade name of "Vano" by the Coppus Engineering & Equipment Co., Worcester, Mass. In the accompanying illustration this blower is shown

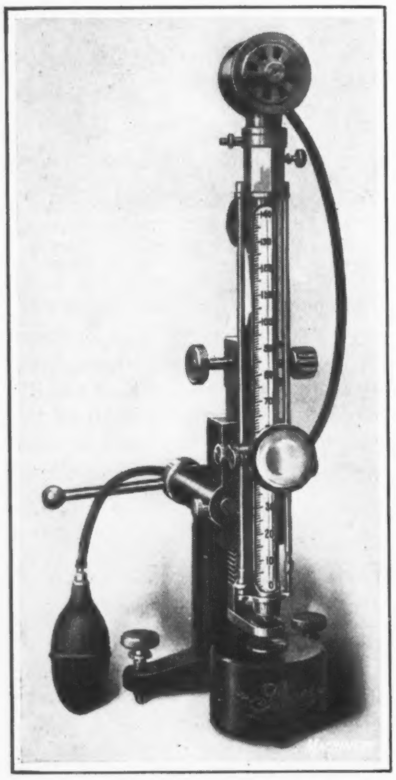
Screw-blade Propeller Blower brought out by the Coppus Engineering & Equipment Co.

arranged with a turbine drive, although an electric motor drive may also be supplied. Air is delivered from this blower in the same direction as that in which it enters. The principal feature is a stationary guide vane beyond the

propeller, which has individual blades that radially subdivide, without shock, the air current leaving the propeller. These blades, which have a curvature that increases in the direction of the propeller rotation, concentrate the air current and give it a further acceleration inside the stationary guide vane, so that a considerable portion of the pressure is produced in the latter. A large part of the end thrust is thus taken up by the stationary guide vane casing. The air streams into which the flow of air is subdivided by the blades rotate slightly as they leave the guide vane casing, and converge toward the axis so that the smallest section of the air flow is beyond the casing.

SHORE IMPROVED SCLEROSCOPE

A number of improvements have been made to the Model C scleroscope which has been manufactured by the Shore Instrument & Mfg. Co., Van Wyck Ave. and Carll St., Jamaica, N. Y., and the improved instrument is now known as "Model C-1." Among the new features is the provision of a special fine screen at the top which prevents dust from getting into the operating mechanism. A tungsten steel piston has been substituted for the leather piston previously supplied, the metal piston being unaffected by temperature and moisture and thus insuring a more uniform operation. The former rigid adjustments for the hammer hook mechanism have also been replaced by a flexible adjustment which greatly prolongs the life of the glass tube. The hammer hooks have also been provided with shock shoulders to eliminate breakage or misalignment of the parts. The improvements largely eliminate the disintegrating effects on the various members due to repeated shocks in testing and reduce the wear of parts.

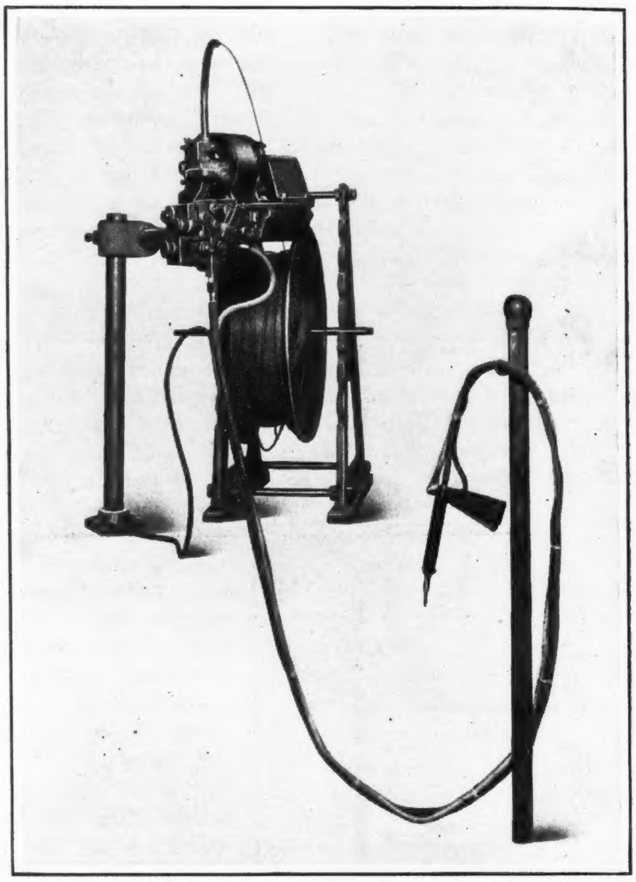


Improved Model C-1 Scleroscope made by the Shore Instrument & Mfg. Co.

GENERAL ELECTRIC SEMI-AUTOMATIC ARC-WELDING TOOL

A semi-automatic arc-welding tool has just been developed by the General Electric Co., Schenectady, N. Y., for use in conjunction with its automatic arc-welding head which was described in March, 1920, MACHINERY. This new device enables the operator to direct the arc as required by the conditions of the work. It is held by the operator, and acts as a guide for the electrode wire. The handle of the tool resembles that of an automatic pistol, and contains a switch for operating the control on the panel of the automatic welder, to start and stop the electrode wire movements.

Attached to the tool is a 10-foot length of flexible steel tubing, having an adapter on the other end for attachment to the automatic welding head. The electrode wire passes from the feed-rolls into the flexible tubing, and thence to the arc through a guide nozzle in the welding tool. With this new device, the automatic welder functions as usual, tending to hold the arc length constant, but the operator directs the arc as required by the particular job in hand.

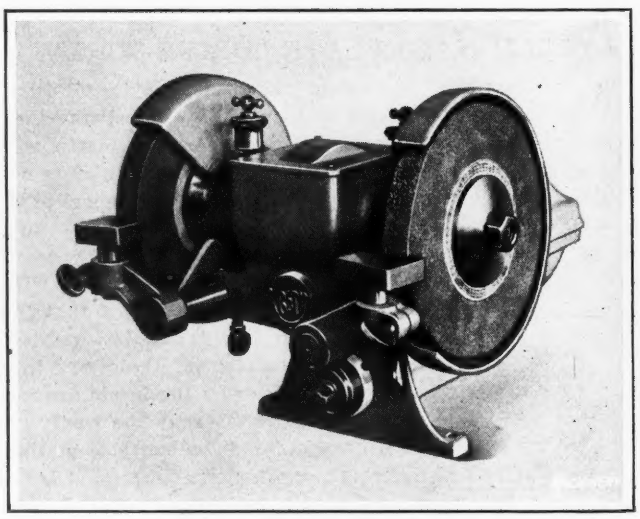


General Electric Arc-welding Equipment with Semi-automatic Lead

The field of application for this tool is work in which the seams to be welded are of irregular contour, or large work where the travel mechanism and clamping necessary for the full-automatic welder would be complicated. In many cases the edges of seams are not accurately prepared, so that there are gaps in some places and tight fits in others. The automatic welder cannot compensate for these conditions by varying the speed or by manipulation of the electrode, but with the semi-automatic arrangement this is taken care of.

BLACK & DECKER BENCH GRINDER

The 8-inch electric bench grinder shown in the accompanying illustration, which is a recent product of the Black & Decker Mfg. Co., Towson Heights, Baltimore, Md., is driven



Black & Decker Eight-inch Electric Bench Grinder

by a ¾-horsepower motor of the universal type, similar to that supplied in portable electric drills manufactured by this company. The motor operates on either alternating or direct current. The grinding wheels are set well away from the motor casing and arranged to overhang the bench. This construction makes it possible to grind long pieces and odd shapes, and also enables the grinding wheels to be worn down to the clamping washers. The motor is air-cooled, the intake for the air being located 12 inches from the grinding wheels, a sufficient distance to eliminate the danger of grit being drawn into the machine. Grease is used as a lubricant throughout. This machine is supplied with one coarse and one fine grinding wheel, 8 inches in diameter and ¾ inch in width. Wheel guards, adjustable tool-rests, and an electric cable are also furnished as regular equipment.

NEW MACHINERY AND TOOLS NOTES

Nut Chamfering Machine: William H. Haskell Mfg. Co., Pawtucket, R. I. A machine made in two sizes for chamfering cold-punched square and hexagonal nuts, from ¾ to 2 inches. The nuts are placed in a chute at the front of the machine from which a feed-finger takes them, one at a time, and places them on a hardened steel die. Here they are chamfered and ejected into a truck or other receptacle.

Balancing Machine: Precision Balancing Machine Co., 3020 E. Franklin Ave., Minneapolis, Minn. A balancing machine adapted for a wide variety of work, including automotive crankshafts, flywheels, and parts readily mounted on arbors. It will receive bodies up to 24 inches in swing and 32 inches in length between bearings. The machine will give dynamic and static balance by two single corrections, individually measured and located near the ends of the body.

Portable Electric Grinding Machine: Arva Stroud, 327 Broadway, New York City. A portable electric grinding machine intended for use on any type of machine tool or in a vise for the accurate grinding of hardened parts. The machine is furnished in two models which are driven by ½- and 1-horsepower motors, respectively. The motors are of the universal commutator type operating on alternating or direct current. Grinding wheels 5 inches in diameter are supplied. The net weight of the machine is 22 pounds.

Cylinder Refinishing Machine: Bridgeport Cutter Works, Inc., 50 Remer St., Bridgeport, Conn. A portable electrically driven machine for reboring and refinishing automotive cylinders, which consists essentially of a sliding head supported on a guiding way carried on the top of the cylinder block by means of brackets. The guiding way may be adjusted in line with the center of the cylinder by means of an indicator. The sliding head carries a cutter-bar which is centered over each cylinder by the aid of an indicator.

* * *

RAILROAD RATES AND WAGES COMPARED

Data prepared by the Bureau of Railway Economics show that since 1915 the average increase in freight rates has been 78 per cent, while the total increase in wages of all classes of railroad employes has been 119 per cent. The figure given for the increase in freight rates is an average of all the schedules increased. It does not mean that the receipts for moving a given amount of freight actually increased by 78 per cent. On the contrary, the average receipts of the railroads per ton-mile increased from 0.722 cent in 1915 to 1.052 cents in 1920, or only 46 per cent, this being due to the fact that the rates were raised proportionately less on the classes of freight that are handled in the largest bulk by the railroads. The wage increase, on the other hand, was actually 119 per cent—the average annual compensation per employe having been increased from $830 to $1820 per year between 1915 and 1920. Hence the comparison should actually be based on a 46 per cent increase in ton-mile receipts by the railroads and a 119 per cent increase in wages.

INDUSTRIAL NOTES AND COMMENT

There have been considerable fluctuations in the iron and steel business during the past weeks, one week indicating a slightly increased output, partly due to an expectation of a reduction in freight rates, and another showing a slight falling off; but sufficient orders are on hand to keep the mills going at the present rate of production. There has been a much better demand from the railroads, orders for rails and cars demanding an increased output of the mills. The tinplate and sheet mills are particularly active. The ingot production during October was more than double that of July, according to reports from thirty companies to the American Iron and Steel Institute. Some of the independent companies in the Mahoning Valley are operating at 65 per cent capacity, the U. S. Steel Corporation averages 50 per cent, and the industry as a whole may safely be said to operate at from 40 to 45 per cent capacity. Several blast furnaces are preparing to resume operation in the Pittsburg district, and the export demand for steel, though still small, is better than at any previous time during the year.

The rumor of a merger of independent companies is becoming more persistent, and it is said that preparatory conferences have been held. The foreign trade in iron and steel and its products is mainly with non-European countries, Japan buying railway materials, sheets, and tinplate, while Argentina has placed large orders here for locomotives and other railway rolling stock and equipment.

Activity in the Automobile Industry

A very keen competition is expected in the automobile field next year, as the productive capacity is above the probable demand. The Department of Commerce reports improved outlook for exports of automobiles. A canvass made of the automobile industry indicates that it is now operating at from 30 to 50 per cent of normal capacity in the Detroit district, with the exception of the Ford plant, which is reported as operating at 80 per cent of its highest peak production. Reports indicate that farmers are buying more freely, both in the grain producing states and in the South.

During the first nine months of 1921, fifty-two passenger cars were reduced, on an average, nearly 20 per cent in price. The greatest reductions averaged 39 per cent for cars below $1000. For cars over $4000, the average reduction was 17 per cent. The average peak price of the fifty-two cars was $2344, and the average present price is $1890.

Railroad Traffic Indicating Increased Business

As is generally well known, the net earnings of the railroads have been quite satisfactory during recent months, due partly to the fact that the roads have spent less for maintenance than during the corresponding period of 1920. It is stated that nearly 200,000 freight cars are in need of repairs. On the whole, railway freight traffic has been quite satisfactory, and during one week in October, for the first time in 1921, the loadings of merchandise and miscellaneous freight (the group which includes manufactured goods) were heavier than in the corresponding week of 1920. The volume of traffic as a whole is now only about 10 per cent less than during corresponding periods in 1920.

Labor Conditions

A report of the Department of Labor and Industries in Massachusetts indicates better industrial conditions in New England, with unemployment from all causes reduced during three months from 25 to 20 per cent, and the amount of unemployment directly traceable to lack of work from 20 to 14.6 per cent. All the unemployment is not due to the industrial depression. The United States Department of Labor estimates that strikes and lockouts in the first half of the present year cost, in wages alone, $1,179,000,000. On the other hand, it is estimated that the direct wage loss due to unemployment because of lack of work amounts to about $4,000,000,000 a year.

STANDARDIZATION WORK OF THE GEAR MANUFACTURERS

In November MACHINERY in referring to the fall convention of the American Gear Manufacturers' Association, the comprehensive standardization program of the association was outlined. In addition to the standardization details there given, the association has formulated a program for the standardization of gearing materials and their treatment, electric railway and mine gearing, transmission gearing, and differential gearing. In order that the cooperation of engineers everywhere may be obtained, the details of this standardization program are given below. It is essential for any real standardization work in the gearing industry that the cooperation of the entire mechanical engineering field is obtained. Those who may desire to communicate with the association in connection with the standardization program should address B. F. Waterman, chairman of the general standardization committee, American Gear Manufacturers' Association, Brown & Sharpe Mfg. Co., Providence, R. I.

Standardization of Gearing Materials and their Treatment

(1) Carbon and alloy steel specifications—chemical and physical; (2) non-ferrous alloy specifications for the following purposes: bronze for spur and bevel gears, bronze for worm-gears, bronze for bushings, and brass for flanges of composition gears; (3) steel casting specifications—chemical and physical—in several carbon ranges for steels for use in casehardened, heat-treated, or untreated state; (4) gray-iron casting specifications—for gears only; (5) specifications of hardness limits which will be acceptable when purchasing bars, forgings, or castings of various chemical specifications; (6) consideration of burnt or badly overheated forgings; (7) recommended practice as to the hardening of hubs and bores to take ball and roller bearings; (8) recommended practice as to the combining of two gears or a gear and a clutch, in one piece; (9) recommended practice on under-cuts and reliefs to clear grinding wheels, and on the use of fillets and elimination of sharp corners; on the prevention of hardening trouble arising from keyways and oil-holes; and on obtaining clean threaded holes in hardened work; (10) recommended practice as to the hardening of bores and fork grooves of gears which slide on splined shafts; (11) recommended practice as to the prevention or control of shrinkage and warping in hardening; (12) report on methods of preventing scale, especially hard and adherent scale; (13) report on the economic factors governing the choice of bar stock, open-hammer forgings, drop-forgings, or upsetter forgings; (14) recommended practice for the inspection of forgings and castings—consideration of defects that call for rejection and those that call for a rebate; (15) recommended practice as to recording of heat numbers and the stamping of these numbers on gears to give the maximum of information without excessive complexity—proposal of standard A. G. M. A. system; (16) report on the design, construction, and operation of furnaces for the heat-treatment of gears; (17) report on pyrometry as applied to the gear industry, with recommendations; (18) report on microscopic examination of metals, as applied to the gear industry, with recommendations; (19) report on the testing of hardness; (20) recommended practice on the selection, test, and use of carburizing materials, and the design and use of carburizing pots; (21) recommended practice on "local" hardening as applied to gear work: (a) local carburizing, (b) local heating, (c) local quenching; (22) report on quenching mediums and quenching apparatus; (23) recommended practice as to depth of casehardening for different classes of gear work, giving consideration to the kind of steel, the tooth dimensions and the hardness; (24) report on researches on the relation of durability and wear of gears to hardness and other factors; (25) a standard nomenclature.

Standardization of Transmission Gearing

(1) Investigate the effects of Hotchkiss drive on transmission with and without slip joints on propeller shafts. Cooperate with Differential Committee on this work; (2) cooperate with other interested organizations to reduce to a minimum the number of bell housing sizes for unit power transmissions. In connection with this, the committee should work with the motor builders and the S. A. E. to establish reasonable manufacturing limits of parallelism and concentricity between flywheel, motor housing and transmission unit, power flange or clutch housing; (3) recommend proper center distances, width of face, pitch and pressure angles of gear teeth for a range of motor torques. Also cooperate with the Spur Gear Committee and the Metallurgical Committee in recommendation of steels; (4) investigate with all concerns who build transmissions, either for themselves or for the trade, any troublesome features in connection with either past or present construction, and report findings for the benefit of the A. G. M. A. in order to eliminate poor designs, either from trouble in the field or from manufacturing difficulties; (5) study and make recommendation for proper lubricants and proper methods of lubrication; (6) recommend proper shapes of gear blanks to reduce to a minimum manufacturing difficulties and heat-treating distortions; (7) recommend case wall thickness for the various types of transmissions and kinds of material; (8) work with the Tooth Form Committee in experimenting with and testing of any tooth form under consideration; (9) inspection.

Standardization of Differential Gearing

(1) Investigate effects of the Hotchkiss drive on differentials with and without slip joint on propeller shafts. Cooperate with Transmission Committee in this work; (2) investigate with all concerns who build differentials, either for themselves or for the trade, any troublesome features in connection with either past or present constructions and report findings for the benefit of the A. G. M. A. in order to eliminate poor designs either from trouble in the field or from manufacturing difficulties; (3) study and make recommendations for proper lubricants and proper methods of lubrication; (4) recommend proper shapes of gears to reduce to a minimum manufacturing difficulties and heat-treating distortions; (5) study the merits of close fitting differential inside gears and pinions, to reduce backlash to a minimum, tending to aid in reducing noise in rear axles, and establish limits based on a good manufacturing basis, in conjunction with the Spur and Bevel Gear Committees; (6) recommend properly designed mountings for differentials to insure load-carrying capacity to keep drive pinion and gear in proper mesh and correct alignment; (7) study effect of thrust on bevel drive pinion and also on bevel ring gear and recommend remedies to overcome any of the objectionable features, in conjunction with Bevel Gear Committee; (8) work with the Tooth Form Committee in experimenting with and testing of any tooth form under consideration; (9) possibility of the use of this committee in consulting way for the members of the A. G. M. A. who may require aid in solving some of their differential problems; (10) inspection in conjunction with the Inspection Committee; (11) cooperate with other interested organizations to reduce to a minimum the various types of differentials for automotive trucks, tractors, passenger cars, etc., to make for less models and greater production on those standardized.

Standardization of Electric Railway and Mine Gearing

(1) Nomenclature, symbols and formulas; (2) design of railway and mine gears in conjunction with other interested organizations; (3) tooth form in conjunction with Tooth Form Committee; (4) materials and treatments in conjunction with the Metallurgical Committee; (5) design of mountings; (6) lubrication.

PERSONALS

WALTER E. HEIBEL, who for the last two years has been eastern district manager of the Wilmarth & Morman Co., Grand Rapids, Mich., has become connected with the New York office of the B. F. Sturtevant Co. at 52 Vanderbilt Ave.

CLYDE E. DICKEY, 233 Broadway, Woolworth Bldg., New York City, has been appointed sales representative for the Metropolitan District of New York City for the Peerless Drawn Steel Co., of Massillon, Ohio, manufacturer of cold-drawn screw stock, shafting and alloy steels.

C. H. HOBBS has been appointed assistant general manager of sales of the Detroit Seamless Steel Tubes Co., Detroit, Mich. Mr. Hobbs was connected with the Lackawanna Steel Co. for more than fourteen years, and for the last five years has been district representative in charge of the Detroit office.

ARTHUR G. HERTZLER, who has been sales manager of the Bearings Co. of America, Lancaster, Pa., and connected with that firm in various capacities over a period of eighteen years, has left Lancaster, and will make his home in Salt Lake City, Utah. He has not yet announced his plans for the future.

F. T. COUP has been appointed district manager of the Cincinnati office at 20 E. 9th St., of the Wagner Electric Mfg. Co., St. Louis, Mo. Mr. Coup is well acquainted with the Wagner line of products, as he has been connected with the company for many years and was until recently in charge of its Milwaukee office.

FRANK W. TRABOLD, for twenty years associated with J. H. Williams & Co., Brooklyn, N. Y., has terminated his connection with that company. Since 1909 Mr. Trabold has been successively sales manager, works manager, general manager, and vice-president. He is at present located at 30 Church St., New York City, but has not yet made definite plans for the future.

HENRY R. TOWNE, chairman of the board of directors of the Yale & Towne Mfg. Co., and honorary member and former president of the American Society of Mechanical Engineers, has been elected honorary president of the Taylor Society. Mr. Towne is said to be the first engineer-executive to appreciate the genius of Frederick W. Taylor, the creator of scientific management.

J. H. WILHELM, LLOYD E. LARSON and JOHN CETRULE, consulting engineers, 18 E. 41st St., New York City, have been elected president, vice-president, and secretary-treasurer, respectively, of the Triplex Machine Tool Corporation of New York, manufacturer of the Triplex line of combination machines. The new connection will not interfere in any way with their consulting engineering practice.

FRED E. HOLTZ has been appointed Milwaukee district representative of the W. A. Jones Foundry & Machine Co., Chicago, Ill., manufacturer of power transmitting machinery. Mr. Holtz assumes his duties immediately, making his headquarters in the First National Bank Building of Milwaukee. He has been associated with the company for the last two years, having been calling on Jones' customers in all lines of business throughout the United States.

ERNEST REICH, formerly vice-president of the Hill Pump Valve Co., Chicago, Ill., and general manager of plant of the Chicago Pressed Steel Co., has recently returned from a seven months' survey of industrial conditions in Europe, and is now engaged in marketing domestic and foreign patents. Mr. Reich has also established connections for exporting novel manufacturing equipment, and would like to receive catalogues and quotations for such equipment, at his office 11 S. La Salle St., Chicago.

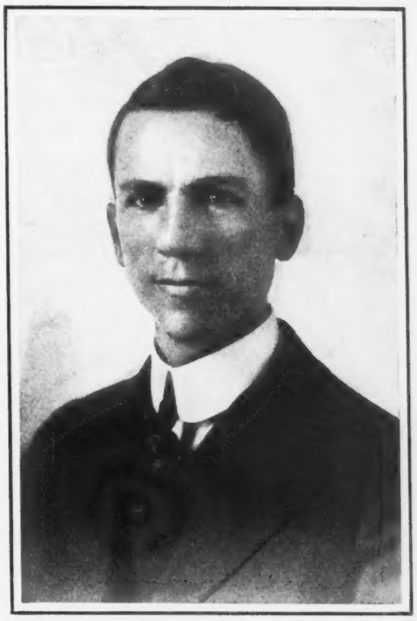
LEONARD W. KEARNS, for many years associated with the leather belting industry, has become affiliated with the sales organization of the Chicago Belting Co., Chicago, Ill. Mr. Kearns has been active in the leather belting business for twenty-two years, eighteen of which he was in the service of one company. He has been branch manager at Atlanta, Ga., Charlotte, N. C., and Chicago, Ill., and has sold belting throughout the United States and Cuba. He has a knowledge of the practical side of the industry, being a belting engineer, and has specialized in the belting requirements of saw mills, steel mills, woodworking plants, flour mills, and machine shops.

STANLEY P. ROCKWELL, 65 Highland St., Hartford, Conn., has engaged in business for himself as a consulting metallurgist. Mr. Rockwell is a graduate of the Yale Scientific School and has had wide experience in the work which he is now undertaking, having been general foreman of heat-treatment and metallurgist of the New Departure Mfg. Co., Bristol, Conn., metallurgist with the E. F. Houghton Co., Philadelphia, Pa., district metallurgist and Captain of Ordnance of the United States Army, vice-president and general manager of the Weekes-Hoffman Co. of Syracuse, N. Y., and metallurgist of the Whitney Mfg. Co., Hartford, Conn. He will continue his association with the last-named company in an advisory capacity. Mr. Rockwell hopes to be able to serve the small concerns whose limited production does not warrant the continual attendance of a metallurgist. He is the inventor of the Rockwell hardness tester, and is also the author of a series of articles published in MACHINERY in 1920, under the title of "Carburizing and Casehardening," as well as other articles relating to heat-treatment.

OBITUARY

CHESTER L. LUCAS

CHESTER L. LUCAS, advertising manager of MACHINERY for the Central West, died in Syracuse, N. Y., on November 3, following an operation for appendicitis, in the forty-first year of his age. Mr. Lucas became a member of MACHINERY'S editorial staff in 1911, changing into the advertising department in 1918; and in both of these fields, differing widely, he achieved a marked success, due not only to his winning personality and sterling qualities of heart and mind, but to his unceasing efforts to serve his advertisers in practical ways. From all parts of the country have come to us letters showing the high regard in which he was held by his business friends.



Mr. Lucas was born in 1881 in Middleboro, Mass., educated in the public schools there and in Providence, and in 1899 moved to Bridgeport and entered the employ of the Schwerdtle Stamp Co. to learn the trade of engraving and die-sinking. After finishing his apprenticeship he went to work for the John Robbins Mfg. Co. of Boston, and afterward for the General Electric Co. in Lynn. While working at the General Electric plant he contributed a number of articles to MACHINERY on the subject of engraving and die-sinking. He was married in 1903 to Miss Ella M. Barnes. His father and brother constitute the firm of J. L. Lucas & Son, Inc., of Bridgeport, in which firm he was financially interested. He was a 32nd degree Mason.

Mr. Lucas leaves a widow and three children, the eldest of whom is in the Exeter Preparatory School. To those with whom he was closely associated in MACHINERY'S organization, who knew him so well and valued him so highly, his loss is a personal bereavement.

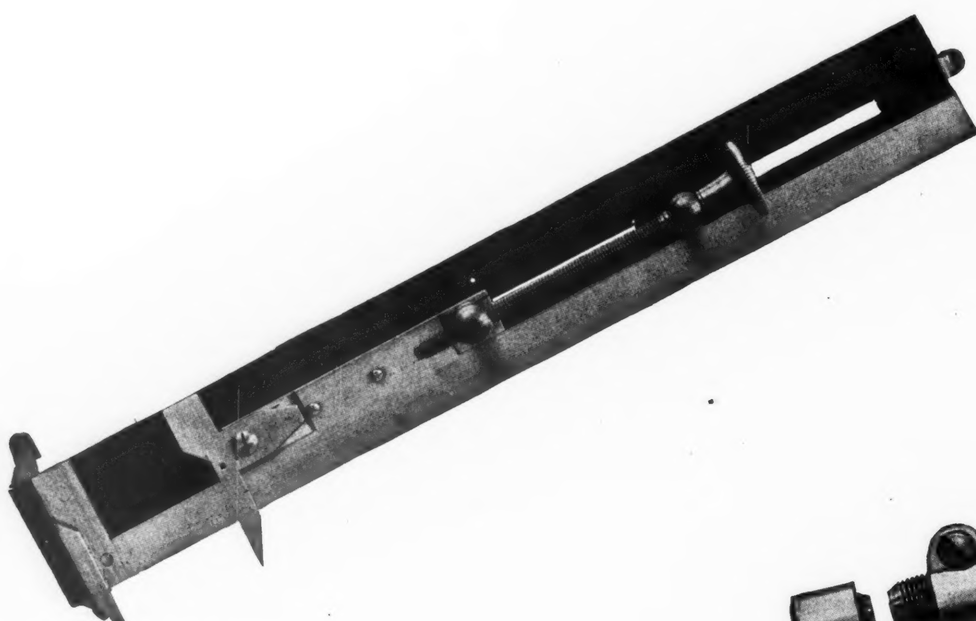
CIVIL SERVICE EXAMINATIONS FOR ENGINEERS, PHYSICISTS AND TECHNOLOGISTS

The United States Civil Service Commission announces open competitive examinations to fill vacancies in the Bureau of Standards. These include examinations for engineers, physicists, and technologists with salaries of from \$2800 to \$4000 a year; for associates with salaries of from \$2000 to \$2800 a year; and for assistants with salaries of from \$1500 to \$1800 a year. Applicants may qualify in electrical engineering, mechanical engineering, civil engineering, chemical engineering, ceramic engineering, radio engineering, engineering of materials, and any other specialized line of engineering. Those desiring to take the examination should apply for Form 2118, stating the title of the examination desired, to the Civil Service Commission, Washington, D. C. Examinations are also announced for junior engineers and junior technologists on January 11, March 8, and May 17. The salary for these positions is from \$1200 to \$1500 a year, and applicants should apply for Form 1312 to the Civil Service Commission, Washington, D. C.

THE FIRST PRECISION TOOLS IN AMERICA—1851

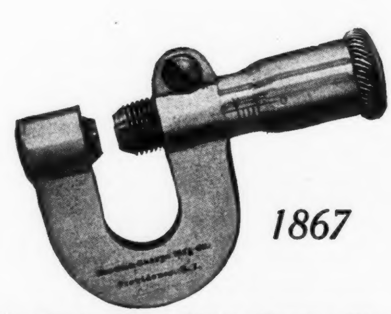
WHEN Joseph R. Brown of the Brown & Sharpe Mfg. Co. gave the world the invention of the Vernier Caliper, he established, 70 years ago, a World-wide Standard of Accuracy. In 1867, Mr. Brown and Lucian Sharpe introduced, in America, the first Micrometer Caliper.

The steadfast and satisfactory performance of these fine tools is a tradition maintained and protected by the conscientious efforts of skilled workmen.



1851

The first and original Vernier Caliper, so far as is known, invented by Mr. J. R. Brown in 1851—over 70 years ago.



1867

"The Pocket Sheet Metal Gauge." The first Micrometer Caliper in America—over 50 years ago—a Brown & Sharpe Product.

BROWN & SHARPE MACHINISTS' TOOLS

represent the accuracy and fine workmanship which only pride in product and experienced master craftsmen can accomplish.

When productive and efficient accuracy are as requisite to industry as now—when extreme caution is used to select the best equipment—Brown & Sharpe Machinists' Tools warrant the special consideration of the prospective purchaser.

See these superior tools in our Catalog No. 28—send for it today.

BROWN & SHARPE MFG. CO.
Providence, R. I.
U. S. A.

ESTABLISHED IN 1833

A Brown & Sharpe Machinists' Tool, perhaps in a Morocco Case, admirably expresses, as a gift, the Spirit of the Yuletide.

B·S
TRADE MARK

NEW BOOK ON BEARINGS

Bearings and Bearing Metals. 120 pages, 6 by 9 inches; 44 illustrations. Published by The Industrial Press, 140-148 Lafayette St., New York City. Price, $1.

Few subjects related to the design or construction of machinery are of greater importance than the subject of bearings. All classes of mechanisms have bearings of some kind, and bearings that are properly designed and constructed are a necessity. As every experienced mechanic knows, a poor bearing may tie up a machine or even cause an entire plant to shut down temporarily. Owing to the importance of this subject, designers and mechanics in general should understand the fundamental principles governing bearing design and should know what approved types are in common use on different classes of machinery.

This treatise deals exclusively with plain bearings, ball and roller bearings being covered in another book of this series. The types of plain bearings illustrated were selected to show how designs are modified to suit different conditions, and also practical methods of arranging bearings to insure adequate lubrication and thorough protection against the entrance of foreign material liable to injure the bearing surfaces. The designs illustrated were taken from actual practice and have proved satisfactory when properly constructed and applied. This treatise contains, in addition to the features mentioned, condensed information on compositions of various bearing metals, their properties, the classes of service to which different bearing alloys are adapted, and the general methods of procedure in designing plain bearings to meet different service conditions.

The book is divided into four separate chapters, the first one covering bearings of different types used in machine construction. The second deals with bearing metals, explaining the characteristics of different alloys and giving the composition of those most commonly used. The third chapter takes up the methods of lubricating bearings, and the last chapter deals specifically with the design of plain bearings.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912

of Machinery, published monthly at New York, N. Y., for October 1, 1921.

State of New York }
County of New York } ss.

Before me, a Notary Public in and for the state and county aforesaid, personally appeared Matthew J. O'Neill, who, having been duly sworn according to law, deposes and says that he is the treasurer and general manager of The Industrial Press, Publishers of Machinery, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, The Industrial Press, 140-148 Lafayette St., New York; Editor, Erik Oberg, 140-148 Lafayette St., New York; Managing Editor, None; Business Managers, Alexander Luchars, President, 140-148 Lafayette St., New York, and Matthew J. O'Neill, Treasurer and General Manager, 140-148 Lafayette St., New York.

2. That the owners of 1 per cent or more of the total amount of stock are: The Industrial Press; Alexander Luchars; Alexander Luchars, Trustee for Helen L. Ketchum, Elizabeth Y. Urban, and Robert B. Luchars; Matthew J. O'Neill; Louis Pelletier; and Erik Oberg. The address of all the foregoing is 140-148 Lafayette St., New York.

3. That there are no bondholders, mortgagees, or other security holders.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

MATTHEW J. O'NEILL, Business Manager

Sworn to and subscribed before me this 27th day of September, 1921.

(SEAL)

WILLIAM E. BACON,
Notary Public, Kings County No. 444
Kings Register No. 3109
New York County No. 79
New York Register No. 3047
(My commission expires March 30, 1923.)

COMING EVENTS

December 1-3—Annual meeting of the Taylor Society in the Engineering Societies' Bldg., 29 W. 39th St., New York City. Secretary, Harlow S. Pearson, 29 W. 39th St., New York City.

December 6-9—Annual convention of the American Society of Mechanical Engineers in the Engineering Societies' Bldg., 29 W. 39th St., New York City.

January 11-14—Annual meeting of the Society of Automotive Engineers in New York City. Secretary, Coker F. Clarkson, 29 W. 39th St., New York City.

April 19-20—Annual meeting of the National Metal Trades Association in New York City; headquarters, Hotel Astor. Secretary, Homer D. Sayre, Peoples' Gas Bldg., Chicago, Ill.

April 24-29—Annual convention and exhibit of the American Foundrymen's Association in Cleveland, Ohio; headquarters, Cleveland Public Hall, Lakeside Ave. and E. 9th St. Secretary, C. E. Hoyt, 140 S. Dearborn St., Chicago, Ill.

May 8-11—Spring meeting of the American Society of Mechanical Engineers in Atlanta, Ga. Assistant Secretary (Meetings), C. E. Davies, 29 W. 39th St., New York City.

NEW BOOKS AND PAMPHLETS

Time Study and Job Analysis. By William O. Lichtner. 397 pages, 6 by 9 inches. Published by the Ronald Press Co., 20 Vesey St., New York City. Price, $6.

This work, dealing with time study and job analysis, is a timely one, in view of the present general interest in the question of reducing costs and increasing production. The aim of the book is to explain the practical application of time study and job analysis in simple non-technical terms. Special emphasis is placed upon the relation of standardization work to problems of management. The author shows how job standardization will increase productive ability, decrease labor turnover and enable manufacturing plants to earn greater returns. He shows how the work of standardization can be handled by training the clerical force already employed, and explains how to make the preliminary study, how to take the time study data, how to determine the rates on operations, and how to apply standardization. He also discusses job standardization in relation to industrial problems. There are six appendixes to the book, in which are given concrete examples of job analyses.

Drawing-room Practice. By Frank A. Stanley. 253 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., New York City. Price, $2.50.

The making of drawings, from the simplest constructions to complete assembly and working drawings of various classes, is dealt with in this book. Because of the difficulty often experienced by students in visualizing the parts to be drawn, use has been made of photographic views of different classes of machine parts, together with actual working drawings. Besides material for the beginner, chapters are included for experienced draftsmen regularly engaged in the production of working drawings, as, for example, the chapters dealing specifically with tool drawings and limit dimensions on working drawings. The thirteen chapters in the book treat of the subject under the following headings: Drawing Instruments and their Uses; Projection; Practical Applications of the Principles of Projection; Development of Surfaces—Intersections; the Helix and its Applications; Screw Threads in their Conventional Forms; Showing Detail Parts—Sections; Parts and Sections in Assembly Drawings; Working Drawings; Working Drawings of Small and Medium Sized Parts; Tool Drawings; Limit Dimensions on Drawings; and Isometric and Oblique Drawings—Shop Sketches.

Machine Drawing. By Carl L. Svensen. 214 pages, 6 by 9 inches; 388 illustrations. Published by the D. Van Nostrand Co., 8 Warren St., New York City. Price, $2.25.

This book has been prepared as a text-book for technical students and draftsmen who have had previous instruction in mechanical drawing but who desire to take up advanced work. It is intended to serve as a guide for the development of an understanding of the relation of machine drawing to engineering. The text is made as brief as a clear presentation of the subject matter permits. A chapter on elementary principles is given as an introduction to the course and for review purposes. Working drawings, drafting-room practice, and idiomatic expressions of the engineering language are discussed, following which there is a chapter on the principles and practice of dimensioning. A study of the common machine details, empirical machine design, jigs and fixtures, etc., is included. About two hundred problems are presented to be worked out by the student, and these are conveniently grouped in the last chapter. The necessary instructions and references to the text are given to enable the student to work out any of the problems. The problems are presented by lay-outs or other specifications so that the instructor is relieved of the preliminary details which ordinarily arise in assigning machine drawing studies.

Waste in Industry. 409 pages, 6 by 9 inches. Published by the Federated American Engineering Societies, Washington, D. C. Sole Selling Agent, McGraw-Hill Book Co., Inc., New York City. Price, $4.

This book comprises a report of the Committee on Elimination of Waste in Industry appointed by the Federated American Engineering Societies to investigate causes of waste in industry. The report is the result of five months of intensive study. It covers an analysis of waste in six typical branches of industry, as follows: Building industry, men's clothing manufacturing, shoe manufacturing, printing, metal trades, and textile manufacturing. The report on the metal trades industry, which is of particular interest to the machine tool field, was written by Fred J. Miller, assisted by William B. Ferguson, and covers present unemployment, extent of the industry, and major causes of waste. It was found that the principal causes of waste are instability of labor employment; inefficient management; restrictive labor organization rules or customs; waste of materials through the lack of a well organized inspection system or lack of training of workers; and lack of thorough research work. In compiling the material covering the metal trades' industry, thirty-two plants were visited and field reports were made out for seventeen plants. In addition to the field reports made in the six industries mentioned, general reports are included on unemployment, strikes and lockouts, legal machinery for settling disputes, industrial accidents, health of industrial workers, eye conservation, and purchasing and sales policies. These general summaries were made from available information compiled by statisticians, economists, and others.

NEW CATALOGUES AND CIRCULARS

New Departure Mfg. Co., Bristol, Conn. Sheet 140 FE for loose-leaf binder, showing application of New Departure ball bearings in can seamers.

R. G. Haskins Co., 27 S. Desplaines St., Chicago, Ill. Circular outlining the constructional features of the Haskins die-filing machine, which is designed to eliminate the delay and expense of filing dies, templets, tools, etc., by hand.

Truscon Laboratories, Detroit, Mich., are issuing a monthly publication known as "The Maintenance Engineer," treating of such maintenance problems as rustproofing steel, protecting concrete against moisture, waterproofing processes, etc.

Sebastian Lathe Co., Cincinnati, Ohio. Catalogue 26, illustrating and describing the Sebastian line of engine lathes which includes two types, the Type S lathe being made in sizes of 13, 15, and 18 inches, and the Type M in 13- and 15-inch sizes.

Benjamin E. Jarvis, Inc., Newark, N. J. Pamphlet entitled "Right to the Line," illustrating the Jarvis portable motor-driven bench band saw for use in automobile body factories, pattern-making shops, manual training schools, and other places requiring a wood-cutting saw.

E. Horton & Son Co., Windsor Locks, Conn., is publishing a series of drill chuck circulars containing descriptive material covering the Horton-Morrow hand-operated ball bearing drill chuck, Horton geared drill chucks with hardened bodies, and Horton two-jaw drill chucks.

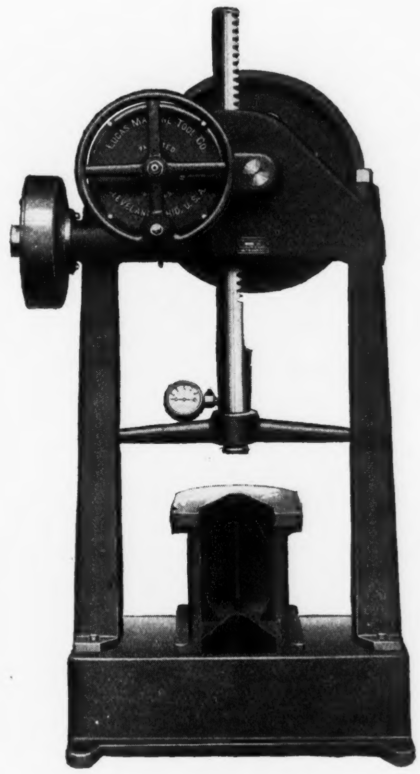
Take Us Into Your Confidence!

We frequently run across some peculiar job that can be done on the

LUCAS
Power Forcing Press

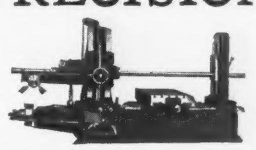
better than on any other machine.

If you have any jobs requiring pressure let us look them over, maybe we can help.



Illustrated Circular
Tells the Whole Story

WE ALSO MAKE THE
"PRECISION"



BORING, DRILLING AND MILLING MACHINE

LUCAS MACHINE TOOL CO. NOW AND ALWAYS OF **CLEVELAND, OHIO, U.S.A.**

FOREIGN AGENTS: Alfred Herbert, Ltd., Coventry. Societe Anonyme Belge, Alfred Herbert, Brussels. Aux Forges de Vulcain, Paris. Allied Machinery Co., Turin, Barcelona, Zurich. Benson Bros., Sydney, Melbourne. V. Lowener, Copenhagen, Christiania, Stockholm. R. S. Stokvis & Zonen, Rotterdam. Andrews & George Co., Tokyo.

Ilg Electric Ventilating Co., 2850 N. Crawford Ave., Chicago, Ill. Circular entitled "Correct Ventilation—That's What Our Men Needed," showing the application of Ilg electrically driven blowers and fans for the ventilation of factories, offices, laboratories, etc.

Smalley-General Co., Inc., Bay City, Mich. Circular containing a number of time studies showing the time required for producing six different parts on the Smalley-General No. 23 thread milling machine. A time study is also given of the threading of a rotary tool joint on the Smalley-General No. 1 thread miller.

Ingersoll Milling Machine Co., Rockford, Ill. Circular illustrating and describing a special heavy Ingersoll adjustable-housing milling machine designed for large and heavy work, the main bed of the machine being 27 feet long, the width over all 31 feet 10 inches, the over-all height 15 feet 4 inches, and the weight 150,000 pounds.

Pawling & Harnischfeger Co., 38th and National Aves., Milwaukee, Wis. Bulletin descriptive of the P & H No. 6 radial wall drill, which has been designed to meet the demand for a simple machine for drilling, reaming, and countersinking large unwieldy pieces, such as structural shapes, boiler plates, long beams and similar bulky objects.

Oilgear Co., 60 Twenty-seventh St., Milwaukee, Wis. Catalogue treating of variable-speed hydraulic power transmissions and illustrating installations of these drives on different types of machines. The Oilgear feed control system comprises a variable delivery oil-pump driven from any available source of power and an oil-motor driven by pressure from the pump.

Whiting Corporation, Harvey, Ill. Catalogue 158 (superseding No. 151) illustrating and describing Whiting standard crane designs, including electric traveling cranes, bucket-handling cranes, gantry cranes, jib cranes, pillar and bracket cranes, and lifting attachments. Tables of clearances for electric traveling cranes and for hand-power cranes are included.

Westinghouse Electric & Mfg. Co., East Pittsburg, Pa. Leaflet 3665, containing data on motors for elevator service, including formulas for selecting motors for this class of service. Leaflet 1732, illustrating and describing enclosed floating switches used on motor-operated pumps for automatically maintaining a water level in open tanks. Leaflet 1950, discussing the advantages of electric drive for power pumps.

Davis-Bournonville Co., Jersey City, N. J. Circular illustrating and describing the Davis-Bournonville new garage and small machine shop welding torch and carrying case outfit. This equipment affords the small shop a convenient means for repairing broken steel, cast-iron, aluminum, copper, brass, and other metal parts. Instructions for setting up and adjusting the apparatus for welding are included.

Stanley P. Rockwell, 65 Highland St., Hartford, Conn., consulting metallurgist and specialist in the heat-treatment of steel, has published a circular containing questions and answers intended to give prospective clients an idea of the work in which he is engaged, and his previous experience. The circular also reproduces a number of letters of recommendations from firms in the metal-working and allied industries.

Chicago Pneumatic Tool Co., 6 E. 44th St., New York City. Bulletin 710, describing the details of construction of the Chicago pneumatic dry vacuum pumps which are made in steam-, belt-, and motor-driven styles. Tables of capacities, speeds, and general dimensions are given for the different classes of machines produced. Special publication No. 674, giving complete specifications for pneumatic hammers, drills, grinders, rammers, and air hoists.

Vanadium-Alloys Steel Co., Latrobe, Pa., is distributing to the trade a reference card containing suggestions for the tool hardener. The card is 8½ by 11 inches in size, made of heavy cardboard and is provided with a cord so that it can be hung on the wall of the hardening room or the tool-room. On the front of the card are given thirty-seven "tips" for the tool hardener, and on the back are listed the various grades of tool steel made by the company.

Gardner Machine Co., Beloit, Wis., manufacturer of disk grinding and polishing machinery and accessories, has published a new sixteen-page booklet containing complete instructions for the proper setting up and use of the Gardner improved abrasive disk. This pamphlet will undoubtedly prove of use to all who are using this improved disk. Two-color circular entitled "The Gardner Improved Abrasive Disk," treating of a heavy abrasive disk manufactured by this company.

Smith & Mills Co., Cincinnati, Ohio. Catalogue 2, containing specifications of the different sizes of pillar type shapers made by this company. The plain crank shapers are made in three sizes of 12, 14, and 16 inches; the back-geared cone drive crank shapers in 16-, 20-, and 25-inch sizes: and the back-geared single-pulley drive shapers in sizes of 28 and 32 inches. The pamphlet also contains a detailed description of the various parts of the machines, and the attachments supplied.

Precision & Thread Grinder Mfg. Co., 1 S. 21st St., Philadelphia, Pa. Circular describing in detail the method of setting and operating the precision thread lead variator, which is used on lathes in conjunction with the multi-graduated precision grinder of this company's manufacture for producing threads with precision leads. By the use of the variator, leads can also be elongated sufficiently to compensate for shrinkage in hardening, and metric threads or threads of unusual lead can be cut.

Vacuum Oil Co., 61 Broadway, New York City. Booklet containing information compiled by the technical department of the company, covering the principle, construction, operation, and lubrication of the surface-ignition type of oil engines. Booklet containing technical data on the mechanical principles, construction, operation, and lubrication of stationary steam engines, as well as information on boiler plant and steam production. Copies of these books will be sent to those interested upon request.

National Acme Co., Cleveland, Ohio. Calendar for November 1921-November 1922 containing on each page, calendar for the current month and the preceding and following months as well as a view of the machines and tools made by this company, including Acme multiple-spindle automatic screw machines, "Namco" self-opening die-heads, Gridley single-spindle automatic turret lathes, "Namco" plain and castellated milled nuts, screw products, "Namco" collapsing taps. and Gridley piston and piston-ring machines.

Collis Co., Clinton, Iowa. Bulletin A, illustrating and describing the "Wonder" quick-change chuck for drilling and tapping machines. Price lists of the chucks, collets, and bushings are included. Bulletin E, containing price lists and capacities of Collis drill chuck arbors which are made to fit any size drill chuck requiring an arbor, and which are furnished with standard taper shanks, Brown & Sharpe, straight, or special tapers. Catalogue 10, containing dimensions and price lists of "Use-em-up" drill sleeves and sockets, drill drifts, lathe centers, lathe bushings, and arbors.

Garrison Machine Works, Dayton, Ohio. Catalogue illustrating and describing the construction and workmanship of the Garrison precision pitch-line control gear chucks, by means of which spur, helical, internal, sprocket, and bevel gears are automatically chucked true with the pitch diameter, thus insuring concentricity of the gear, regardless of errors in turning or mounting on the arbor of hobbing or generating machines. Specifications are given for the different styles of chucks. Circular of Garrison gear chucks, showing how the use of these chucks enables production to be increased and reduces the size of the scrap pile because of the precision control.

Simmons Method-Hob Co., Second St. and Duncannon Ave., Philadelphia, Pa. Catalogue containing tables of sizes and prices for Simmons method-hobs, which are provided with generated teeth of different forms for hobbing gears of various types. The tables give data for hobs used on Adams-Farwell machines, Barber-Coleman No. 12 machines, Lees-Bradner main cutter-arbors, Lees-Bradner fast cutter-head machines, Gould & Eberhardt machines, and Schuchardt & Schutte machines. Tables are also given of dimensions for B & S standard 14½-degree gear tooth parts, gear shaper 14½-degree system, gear shaper stub tooth system, and gear tooth and hob tooth parts for the Simmons standard involute system.

National Tube Co., Pittsburg, Pa. Bulletin 13, treating of National hammer-weld pipe. This circular contains a detailed description of the manufacture of lap-weld pipe 24 to 96 inches in diameter by hammer-welding illustrated with views showing the various steps in the process. Following the article on manufacture is an outline of the characteristics of hammer-weld pipes, including physical properties, bursting and collapsing strength, carrying capacity, and comparative discharge rates. The bulletin also discusses installation advantages, protective coatings, joints, and uses of hammer-weld pipe. Complete specifications of the different sizes are given, as well as tabular material and formulas relative to the flow of water in pipes.

Garrison Gear Grinder Co., Dayton, Ohio. Circular describing the features of construction of the Garrison gear grinder, which is designed for generating and grinding the teeth of hardened gears. By the use of this machine, tooth contours of any pressure angle can be generated, the correct contour and size being automatically produced after the diamonds are set and the wheel dressed to grind teeth of the desired size and pressure angle. The advantages claimed for this machine are use of only one wheel; elimination of precision adjustments; economy and strength of wheel; generation of teeth of correct contour and size; elimination of heat; accurate indexing of work; simplicity of operation; durability; and elimination of finishing cuts ordinarily taken on gear-cutting machines.

Eastern Machine Screw Corporation, 23-43 Barclay St., New Haven, Conn. Catalogue descriptive of the H & G self-opening die-heads, containing 96 pages of material, completely indexed, and approximately 51 illustrations. The book is wider in scope than a regular catalogue, containing also data which should be useful to the man working out threading problems. It describes in detail the features of construction of the H & G die-heads, and gives sizes and capacities of the four types, which comprise the Style A rotating die-head, the Style B "Ford Special," the Style C non-rotating type, and the new Style D die-head for use on Brown & Sharpe automatics. The single-spindle and double-spindle H & G threading machines are also described. A special section is devoted to the chasers for H & G die-heads, and information on ordering the heads and chasers is included. Operating instructions are given, as well as complete instructions for grinding chasers, the latter being a new feature of this edition of the catalogue. Another of the products illustrated and described is the H & G chaser grinder. The last section of the book entitled "Useful Information" contains data pertaining to standard threads, decimal equivalent tables, and tables giving weights of cold-drawn steel screw stock, and cutting speeds.

TRADE NOTES

Seneca Falls Foundry Co. has recently rented the foundry of the Seneca Falls Mfg. Co., Inc., Seneca Falls, N. Y., manufacturer of "Star" engine lathes and "Short-cut" lathes.

Peerless Machine Co., 1611 Racine St., Racine, Wis., announces that a substantial reduction has been made in the price of Peerless high-speed saws, effective October 20. Revised price lists have been issued.

William S. Walker Co., Park Bldg., Pittsburg, Pa., advertising agent, has opened an office at 340 Leader-News Bldg., Cleveland, Ohio, which will operate for the present as a sales office and by the first of the year will be used as a service office.

Cincinnati Hy-Speed Machine Co., Cincinnati, Ohio, has made an exclusive selling arrangement with the Niles-Bement-Pond Co., 111 Broadway, New York City, covering the full line of "Hy-speed" products. Circulars of "Hy-speed" drilling and automatic tapping machines are now ready for distribution.

Joseph T. Ryerson & Son, Jersey City, N. J., have moved their general offices from 30 Church St., New York City, to their plant office building, West Side Ave., Jersey City, and request that all correspondence be sent to that address. The company will continue to maintain its sales and export offices at 30 Church St.

Loy & Nawrath Co., 21 Runyon St., Newark, N. J., manufacturer of power brakes, squaring shears, miter presses, and forming and miter dies, has opened a New York office in the Hudson Terminal Bldg., 30 Church St., Room 1922. The telephone number is Cortland 6297. All correspondence should be addressed to the New York office.

Coats Machine Tool Co., Inc., World's Tower Bldg., 110 W. 40th St., New York City, has obtained the exclusive agency in the United States for the original Hirth minimeter and "Fortuna" internal and face grinding spindles. The supply of Hirth minimeters in this country was discontinued at the outbreak of the war in 1914, and users will be glad to know that they can now obtain these instruments in the United States.

Timken Roller Bearing Co., Canton, Ohio, was one of the exhibitors at the National Exposition of Mines and Mining Equipment, held in conjunction with the recent convention of the American Mining Congress in Chicago. The Timken exhibit showed the application of tapered roller bearings in the mining industry. Mine car axles equipped with Timken tapered roller bearings were features of the exhibit, and samples of bearings were also shown.

Arrow Machinery Co., 234 N. Third St., Philadelphia, Pa., has been organized to deal in machine tools, shop equipment, and small tools, and would like to receive catalogues, price lists and dealers' discount sheets from manufacturers. W. A. Heilprin, head of the company, has been a manufacturer of sheet-metal specialties for many years, and was maker of the "Columbian Safety" air gun. He was also manager of the Metalform Tool & Stamping Co., manufacturer of jigs, fixtures, tools, and dies.

Rockford Tool Co., 2400 Eleventh St., Rockford, Ill., has appointed the Crane Machinery Co., 501 Morgan Bldg., Buffalo, N. Y., exclusive distributor of the Sundstrand 9-inch manufacturing lathe in the Buffalo territory. The Crane Machinery Co. will also represent the Rockford Milling Machine Co. in Buffalo. The Aumen Machinery Co., 107 E. Lombard St., Baltimore, Md., has been appointed exclusive distributor for the products of the Rockford Milling Machine Co. and the Rockford Tool Co. in the Baltimore territory.

Wetmore Mechanical Laboratory Co., 129 Michigan St., Milwaukee, Wis., which was organized in 1915 by Charles P. Wetmore and P. B. Rogers is again actively engaged in engineering and manufacturing work. This company designed and manufactured the Wetmore inserted-blade expanding reamer which was used in the production of shells during the war, and later developed commercial reamers of this type. The company will now devote its efforts to developing mechanical devices and to perfecting manufacturing methods, including jigs, fixtures, and tool work; it is also handling contract manufacturing work, as well as die and screw machine work. The president of the company is Charles P. Wetmore, and the secretary and treasurer, P. B. Rogers. Mr. Wetmore will be in charge of the mechanical work.